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The Oldest American Aeronautical Magazine

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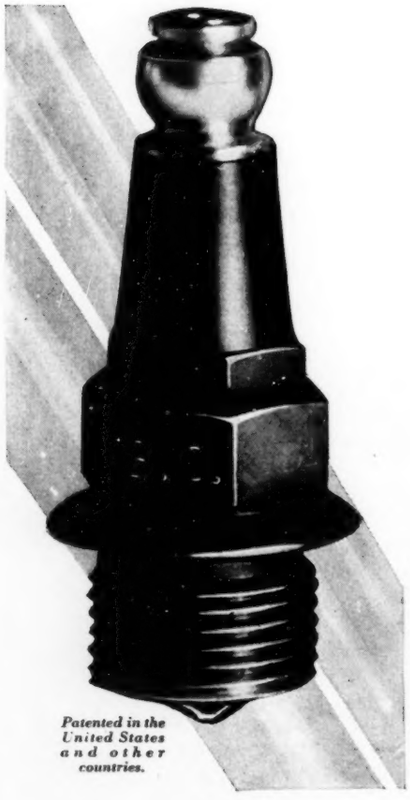

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AVIATION

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The Oldest American Aeronautical Magazine

EDWARD P. WARNER, *Editor*

LOUIS F. STOLL, *Publishing Director*

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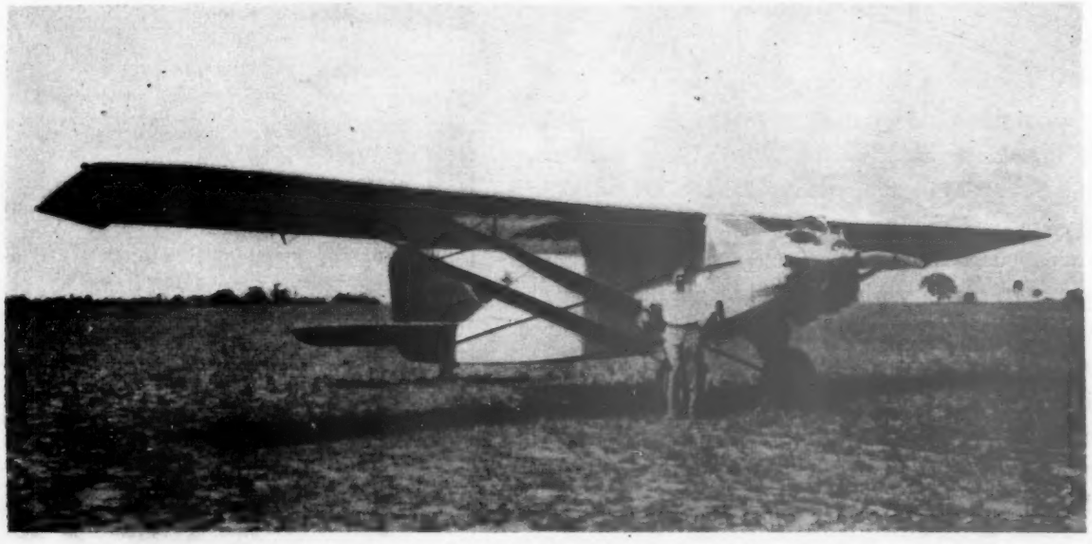
BELLANCA PLANES
have Structural Strength of
SUMMERILL TUBING



Six successful flights across the Atlantic by Bellanca planes are now climaxed with the new Word's Long-distance, Non-stop Record of 5014 miles from New York to Istanbul, Turkey. These ocean trips are but a few of the many famous fiights by Bellanca Aircraft. And, as usual, Summerill Tubing is the strength behind these record-making planes.

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Build up your out-of-season revenue with

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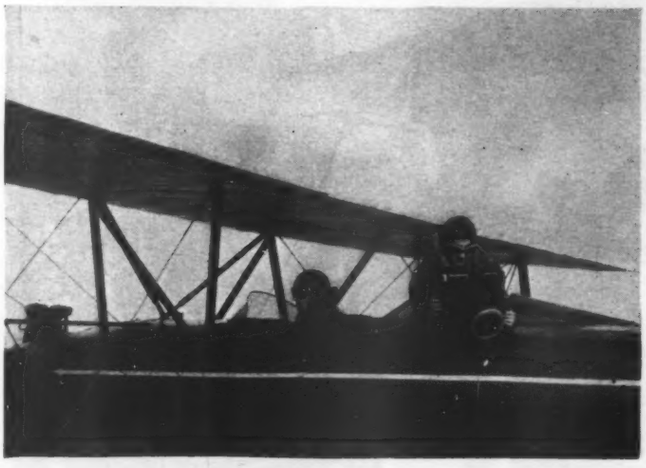

FALL is here. Winter is just around the corner. Soon the long season of lessened income will set in. As an aircraft operator, how are you planning to bolster income in these off-months to come?

Many organizations are turning to Aerial Photography. In this year 'round business, they have discovered a sure source of steady income—one that carries a two-fold profit. *There is one profit from the flying operation involved and a second from the sale of the photographs themselves.*

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Aerial Photography is a logical extension of your present activities. No additional personnel is required. Anyone that can take a snapshot can operate the Fairchild Aerial Camera and get good results every time. And your local photographer can develop the films.

It's easy to get started in this business. All you need is a Fairchild F-8 camera. The investment is most moderate, doubly so by reason of deferred payments. In fact, many operators pay out of earnings.

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Newfoundland to Denmark

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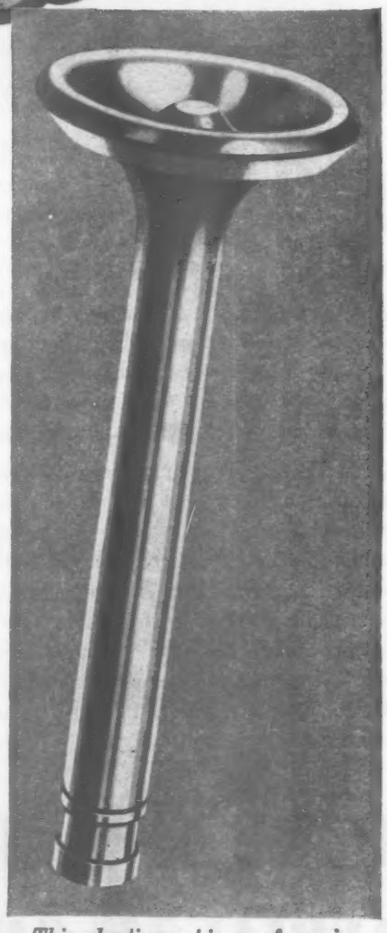

This advertisement is one of a series recalling historic airplane flights in which Thompson Valves were used.

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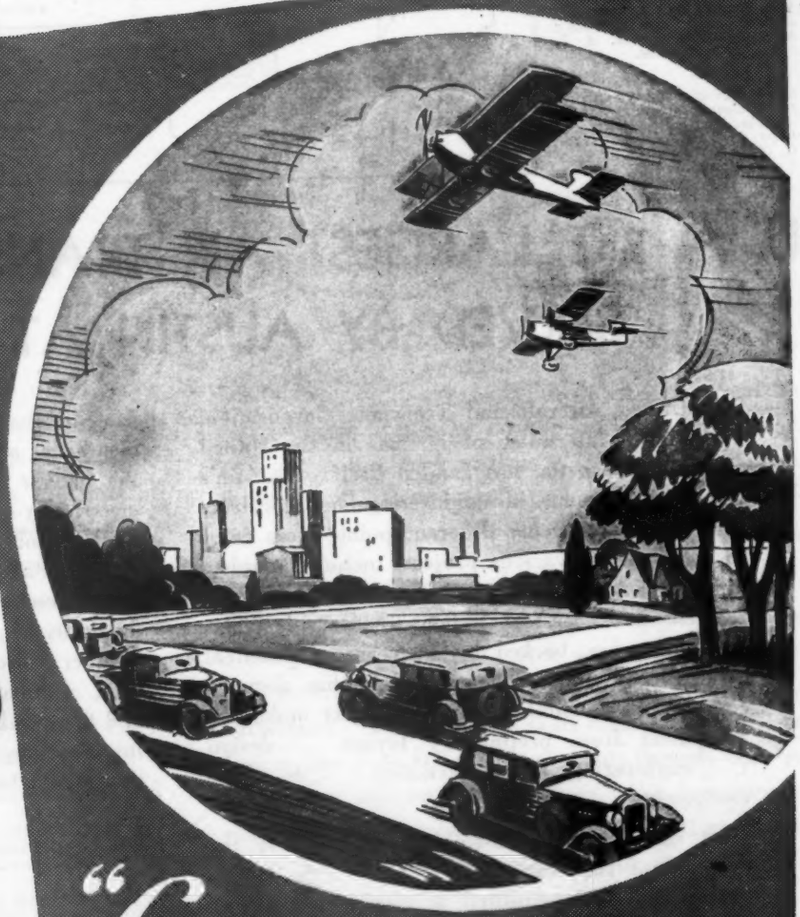
for the last 30 years !



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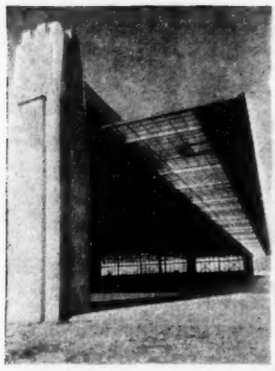

United Hangar No. 3 — 310 x 248 ft. hangar designed, built and equipped by Austin for U. A. & T. Corp., Los Angeles.

Stars indicate the 20 points from Coast to Coast where Austin Airport Engineers have designed and built for U. A. & T. Corp.

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Another hangar designed and built by Austin for U. A. & T. Corp.

Before proceeding with a hangar project of any size investigate fully the many advantages of the Austin 1931 Model Hangar and see the remarkable Austin Kanopy Doors in actual operation. Wire, phone, write or use the memo below.

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Position..... Firm..... City..... A 9-31

AVIATION
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The Oldest American Aeronautical Magazine

EDWARD P. WARNER, *Editor*

VOLUME 30 . . . *September, 1931* . . . NUMBER 9

Notes on governmental economy

THE halcyon days are over. Years when every Treasury estimate of governmental finance, however roseate, proved to have been conservative have given way to years in which the federal deficit gathers momentum like a snowball and finally has to be measured in ten figures. As a natural reaction, every bureau and department receives instructions to tighten its belt and reduce its rations. Where does that leave us?

¶To say that the aviation industry has a peculiar interest in the answer to that question, perhaps a keener interest than any other business group in the United States, is putting it very conservatively. *At least temporarily (we, at least, believe that it is temporary), the clock has been turned back to* 1922. *Again, as just after the war, the industry finds itself dependent on government support. Our first line of defense, in the endeavor to preserve some measure of the gains that have been made through three years of industrial expansion, public enthusiasm, and energetic prosecution of research, is military and naval business. The second line is governmental support of air transport through mail contracts and provision of ground facilities.*

¶As we inspect the record of the last eighteen months we have reluctantly to admit that there has been complete demonstration that the manufacture of commercial airplanes cannot, under the conditions of the present depression or any conditions that are likely to exist in the near future, sustain a substantial industry. A small number of companies can do, and are doing, very well at it. The bulk of the industry finds it absolutely necessary to depend, for the next few years, on government orders of a military nature.

¶We digress in passing to remark that we have lost none of our confidence, often expressed in the past, that air transport is on the high road to complete self-sufficiency. The need for mail contracts placed at a loss to the Post Office Department, though very real at present, will be a passing one. But however that may be, and however generous the action of Congress and the Postmaster-General might be, air transport offers only a feeble staff for the builder of planes to lean upon. The number of planes needed is so small, and their life before replacement so long, that even ten times the present amount of transport activity would be an inadequate foundation for the airplane industry which America ought to look forward to ultimately maintaining upon commercial lines, the industry for which we had prepared two years ago.

¶Again, as ten years ago, we have to bridge over an interim period of crisis. This will be the last such period. It comes as the aftermath of an abnormal boom, with the natural swing down from the peak intensified by the arrival of a universal economic collapse at almost the same time. It is easy now to see

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that the hopes of 1929 were exaggerated. It is easy to realize our own mistakes. But to dwell upon them does little good in the present situation. *As Grover Cleveland remarked in an earlier period of economic distress, it is a condition and not a theory that confronts us. The condition is that we can easily lose most of the gains of the last six years,—that the trained personnel and the accumulated material resources of the aircraft industry can easily be wasted and broken and scattered to the four winds of heaven,—and that those things are likely to happen in very large measure unless Congress and the administration deal with the industry in a sympathetic spirit.*

¶ The screws are being put on to secure governmental economy. One by one, the Cabinet officers have been called to the Rapidan and enjoined to shave their expenditures for the present fiscal year and their budget requests for the coming one. There is a specious attractiveness about the theory that economy is most readily accomplished, with a minimum of hardship, by maintaining existing activities and avoiding any enlargement of organization or embarkation on new undertakings. Experimental military aircraft, for example, or for that matter the purchase of any aircraft beyond the minimum necessary for replacement, might appear a luxury that could easily be postponed. Why not?

¶ There are several excellent reasons why not. We have already suggested one. *The aircraft industry is a national asset, a vital element in all industrial planning for the national defense. It has suffered grievous attrition in the last two years. That attrition simply cannot be allowed to proceed much further. There is no question here of industrial subsidy, nor of unduly delicate consideration for the feelings of suffering investors. The national interest is deeply and directly involved in the preservation of our aircraft-manufacturing facilities, intact with proper engineering organizations. To cut down on military purchases, or to follow a course, in the guise of economy, which discourages engineering initiative and experimental development within the industry, is to hazard that national interest very gravely.*

¶ That is bad enough. But there is another factor even more serious. The major problem before the people of the United States is not the appearance of red ink upon the books of the Treasury Department, but the truly alarming figures of unemployment. There is at least a possibility that direct federal aid will have to be extended before we are through the coming winter. It is more economical, and it is far better from the point of view of social effect, to spend money keeping men at work than to spend the same amount in doles to enable them to remain idle without starvation. Money spent in the aircraft industry goes principally to give employment and pay wages to skilled American labor. There is a fallacious doctrine, much heard lately, which holds that wages make up but a small part of the costs of production. With the exception of profits, rent, fixed charges on capital, and executive salaries, wages make up the whole cost,—wages at some point along the line. They may be paid in the factory that assembles the airplane, or in a plant that rolls duralumin sheet, or in a bauxite mine, but they all contribute to employment. In airplane manufacture even more than in most other lines of industry, wages play a preponderant part. Profits certainly have not been excessive,—ask any investor. Rent has been a small fraction of total outlay. The methods of raising capital were such that fixed charges play almost no part. *It would probably be conservative to say that, out of every dollar received for the sale of aircraft and parts, at least* 65 *cents goes into the pockets of labor and technical and clerical personnel. Relatively few industries could show so high a figure. Money spent at the present time in the purchase of aircraft, regular production or experimental, for the government service is a direct and efficient measure of unemployment relief. Either to reduce the present allotment for such purchases, or to do anything that will accentuate the industry's present uncertainty about future programs, is to contribute directly to unemployment troubles.*

¶ Under the approximately stabilized conditions from 1928 to 1931, allotments for new aircraft and for experimental equipment for the Army and Navy totalled about 30 million dollars each year. The present fiscal year shows the first sharp drop, to a figure 12 per cent below that for the year immediately preceding. With the Navy's original five-year program completed and the Army's drawing toward its final stages, and with a general demand for reduction of all expenditures and particularly military ones, there is widespread discussion of the likelihood of a further slash. That implies no Congressonal or administrative prejudice against aviation. Far from it. Cuts are being made all along the line. But the effect of cuts in this particular field is going to be particularly serious,—even disastrous.

U.S.S. Akron weighs off

NOTHING was more impressive, on the occasion of the formal christening of the Navy's great new airship, than the handsome representation of the airplane industry. Builders of airplanes and builders of engines had come to Akron, and some of them had travelled 500 miles or more to do so, to pay honor to a craft of a type with which they have had no commercial connections,—from which they could expect to draw no profit,—and which some of their colleagues have in the past been disposed to consider as a rival and a competitor for shares in an inherently limited amount of transport business.

If their presence is symptomatic a major obstacle in the way of the financing and inauguration of trans-oceanic airship lines will have been removed. If the heavier-than-air faction regard the airship with suspicion or scorn, its difficulties in gaining popular acceptance are much more than doubled. If they welcome it with enthusiasm as an ally, lay bankers and investors are encouraged to do likewise.

The need for sobriety and a reasonable measure of conservatism is particularly acute at the present time for the advocates of the airplane are in danger of acquiring a superority complex on trans-Atlantic flying. In happy contrast with the tragic record of previous years, the first five attempts of the present summer have attained unanimous success. It is easy to forget that oceanic flights are still being made only in carefully selected weather, warranted by Dr. Kimball, and with a very modest payload,—and that the insurance premiums on such flights as commercial undertakings would still be very high.

The lamented Sir Sefton Brancker, lost on the R.101, once remarked to the editor of AVIATION that he believed the time would come when the airship would be unneeded and outworn, for the airplane would be able to cover the entire expanse of the globe in regular and economical service, but he put that time very far in the future. For the present the airship must be our chief reliance for commercial services of over 1,500 miles without stop. On the other hand, supporters of the airship must and generally do accept its own limitations and restrict it to its own proper field. Needless to say we have no sympathy with the bizarre proposal, recently urged in a very high place, of putting rigid airships to work in a night shuttle service across the Rocky Mountains to supplement the day-time operations of airplanes. Such a scheme would be neither commercially necessary, economical, nor safe.

When we think of the future of airships, whether naval or commerical, our eyes turn towards Akron and towards the ship that bears the name of the city, just about to receive her first trials as this editorial is written. That the U.S.S. Akron exists at all is due to the success of the Navy Department, and most particularly of Admiral William A. Moffatt, in convincing a doubting Congress and a doubting President that airships still had a place in the Navy after the Shenandoah was lost. It is due also to the unshaken confidence of Paul W. Litchfield in the airship, and to his ability to persuade his startled associates that a great rubber company in the world ought to go into the business of fabricating duralumin into hulls a sixth of a mile long. The ship as it stands today, a finished product, represents the engineering genius of Karl Arnstein and a group of his co-workers who came with him from Friedrichshafen, together with the contributions of Comdr. Garland Fulton and other naval officers and those of many industrial and research organizations in the United States and abroad. Whatever is novel in the Akron,— and there is much that comes under that heading,—is the product of exhaustive theoretical investigation backed by thirty years of practical experience. She takes flight under the best auspices, in the hands of Commanders Rosendahl and Wiley and others of unexcelled talents. Everyone interested in aviation, whether directly connected with airship activities or not connected at all, will wish her well.

Performance regulation and the way out.

PAGE 64 of Bulletin 7A of the Aeronautics Branch, the airworthiness requirements, contains a very sore spot. It is set forth there that no landplane must have an initial rate of climb of less than 350 ft. per min., that none must land at over 65 m.p.h. if it is to carry passengers, 70 if it is to handle freight alone.

The performance stipulations passed without serious challenge at the recent meeting between the manufacturers and the Department of Commerce to discuss the revision of the bulletin, but it was only a truce, or a prudent withholding of combat in an area where there is no chance of present victory. A substantial body of opinion in the industry remains convinced, as we are convinced, that the whole principle of general performance specifications by government authority is unsound, unnecessary, and of very questionable effect on safety. We believe it imposes upon the Department a task which can never be satisfactorily fulfilled. We believe that the Department ought to extricate itself from that particular embarrassment, and that the way of doing it is plain. We earnestly hope that the way will be taken.

Conceive of two airplane owners. One is resident in Oklahoma, and uses his machine almost entirely for trips in that state and those immediately neighboring. He never flies at night, nor across mountain ranges. His trips are almost entirely between large cities, with first-class airports. The other is from the mountains of West Virginia, and lays great stress on the ability to operate in poor weather and to get into emergency fields near small towns having no regular landing-places. Obviously their landing-speed and rate-of-

climb requirements are by no means the same. What is quite reasonable for the first would be far too dangerous for the second. What might be ideal for the second would be inefficient and wasteful for the first.

There is no single body of rules that will cover all cases. There is no standard performance that meets safety requirements equally well over every kind of terrain, at all altitudes, and in all sorts of climate. Bad enough when only the domestic market is under consideration, the problem is ten times more difficult when foreign trade, with conditions ranging from those of the Australian desert to those of the mountains of Bolivia, has to be reckoned with. Present practise lays a needless burden on the exporter. There is no imaginable set of specifications including those now in force, which would not be either so severe as to force unnecessary sacrifice of efficiency and economy, or so lenient as to be dangerous,—for too low a specification is far more dangerous than none at all. The purchaser feels that when the Department has set up a requirement and certified a machine to meet it there is nothing more to be said on that point. He feels that he has a guarantee from the federal government that the landing speed is low enough, and the climbing powers sufficient, to meet all the exactions of safety. He surrenders his natural right of individual judgment in the light of the individual pecularities of his own case.

Fortunately there is an easy escape from the dilemma. There are two escapes, one applicable to the equipment of transport lines and the other to all other service.

The Aeronautics Branch has the transport situation completely in hand. It now enforces rules affecting the selection of personnel, the training to be given them, the radio installation on the planes, and a host of other details of equipment and operation. It has only to extend the requirements for a certificate of authority to operate so that they will cover the choice of the airplanes themselves, and cover it in detail. It appears to us entirely reasonable that an operator should give actual demonstration of his ability to land the particular type of machine that he selects, fully loaded, in each of the emergency fields along his route. If the fields are small, or at high altitudes, the planes used must be selected with due recognition of that fact. If there are no fields for stretches of 50 miles or more the landing speed should be absolutely limited to 55 m.p.h., and perhaps to even less. Climbing characteristics, like landing speeds, should depend absolutely on the route to be flown and the loads to be carried. The performance needed for safety is a relative matter. The transport operators, at their meeting with Secretary Young, showed themselves very desirous of having each line treated as a special case, avoiding general rules. Here is one that can very readily and profitable be abandoned.

In the case of non-transport airplanes, and especially of those purchased for individual use, the government has no such direct responsibility in respect of performance as it has in dealing with structural strength, and the purchaser should be allowed the exercise of his own judgment. There is, however, one preliminary condition. There must be some reliable data upon which judgment can be brought to bear.

At that point, the Aeronautics Branch again enters upon the scene. Published performance data at present are of variable accuracy and subject to natural suspicion, both at home and abroad. The Branch will be doing a service to the purchaser, to the honest manufacturer and dealer, and to the safety of aerial navigation if it will actually measure in full detail the performance of every plane that comes up for approval, and then publish the results to the world as a part of the A.T.C. Then, for the first time, the customer will have a reliable guide for the winnowing of the samples submitted for his favor. Then declarations about landing speed will begin, taking them as a whole, to have other than a humorous significance. And then the Department of Commerce can unhesitatingly abandon the uneconomical and unreasonable practise of forcing the industry to fit it products into the Procrustean bed of flat and inflexible performance minima.

Japonic punctilio

GREAT is the majesty of Japanese law, and its dignity has been preserved. Herndon and Pangborn become the unfortunate victims of their own haste and ignorance of regulations to which they had no possible access, and the Japanese exchequer is the richer by $2,000. We are speaking as sincere friends of Japan, and addressing ourselves particularly to our Japanese readers, of whom we are proud to have many, when we say that the action taken was lamentably unwise, that it will create serious ill feeling, and that it will accomplish no good purpose whatever.

Air navigation laws and prohibited zone rules must be obeyed. Even in a round-the-world flight against time, they cannot be lightly disregarded. American pilots must realize that there are certain formalities to be complied with before entering any foreign territory, and that fortifications are more respectfully treated in Europe and Japan than in the United States. But any law must be interpreted with a grain of discretion where there is no evidence of wilful wrongdoing, especially when international relations are involved. The first days of the fliers' examination accomplished to the full the very proper purpose of drawing world-wide attention to the fact that the Japanese take their own regulations seriously and insist that others do likewise. To confiscate films taken over forbidden territory was of course perfectly reasonable. To go on after that and levy a heavy fine appears only as a futile and spiteful gesture, and as a notification that American aerial visitors are not wanted in Japan. Resentment here will be widespread and genuine.

News of the Month

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Record flights on three continents

AFTER an unsuccessful attempt a week earlier to get their heavily loaded plane off the ground, Russell Boardman and John Polando took off from Floyd Bennett Airport, on July 28, for Istanbul, Turkey. Forty-nine hours, 19 min. later they landed at Yechilkey Airdrome, Istanbul, 4,999 miles distant according to the computations announced officially by the F.A.I., to exceed by 87 miles the non-stop distance record previously held by Dieudonne Coste and Maurice Bellonte. Boardman's Bellanca monoplane, the Cape Cod, with a 300-hp. Wright engine, weighed 7,500 hp. as it left the ground carrying 25 gal. of oil and 728 gal. of gasoline, which was consumed down to the last pint.

The attempt of Marcel Doret and Joseph Lebrix to break the Coste-Bellonte record in a 6,000-mile flight from Paris to Tokyo was unsuccessful. Engine failure during a storm in mid-Siberia caused a crash in which the Dewoitine monoplane which had just established a new world's record of 6,560 miles for distance in a closed circuit without refueling was almost completely demolished.

Also following the trans-Siberian route was the Puss Moth of Miss Amy Johnson, who landed in Tokyo on Aug. 6, completing the trip from London which a forced landing near Warsaw had compelled her to discontinue last January. Flying time from London, via Berlin, Moscow, Irkutsk, Harbin (Manchuria), and Seoul (Korea), about 78 hours, 50 min.

Col. and Mrs. Charles A. Lindbergh are approaching Japan from the east on a leisurely vacation flight which has taken them through little-traveled wilderness regions around Hudson's Bay and up to the Arctic Circle. Washington was the starting point of the route which included North Haven, Ottawa, Moose Factory, Churchill, Baker Lake, Aklavik, where an Artic storm held them for several days, Point Barrow, and Nome.

Thunderstorms over Europe and fog over the English channel delayed J. A. Mollison on his flight from Australia to England, but did not prevent his cutting two days from the record time recently made by Flight Lieut. C. W. A. Scott. Mollison's Gipsy Moth plane covered the 10,000 miles from Wyndham, West Australia, to Croydon in 8 days, 20 hours, 19 min. while Scott's time was 10 days and 25 hours. Mollison's time was four hours more than Post and Gatty required to go around the world—his distance flown, 5,000 miles less.

James G. Hall and Frank Hawks have been breaking each other's records for the hop from New York to Havana. "To Help End Prohibition" Hall, on July 18, clipped 46 minutes from Hawks' best previous time, covering the 1,400 miles in 8 hours, 35 min., in his Lockheed Altair monoplane with retractable landing gear. He flew non-stop. To have lunch with Ambassador Guggenheim, on July 25, Captain Hawks flew to Havana in 29 minutes less time in his much-travelled Mystery Travel Air and was back in New York for dinner the same night. His return trip, made in 7 hours, 30 min. was also a record, the round trip, with an hour and 27 minutes for luncheon, besides four fuel stops, taking seventeen hours and three minutes, three minutes more than he had planned.

Blazing the trail for the air mail

With no eye to records, but to survey a possible air mail route from Detroit to Copenhagen, Parker Cramer recently made the first flight ever completed across the Greenland icecap. With a Canadian government radio expert, Oliver Bacquette, he left Detroit on July 27 in a diesel-engined Bellanca, stopping at various points in Canada and at Pangnirtun (Baffin Bay), Holsteinborg, and Angmagsalik (Greenland) Reykjavik (Iceland) and the Faroe and Shetland Isles. Taking off for Copenhagen just before a gale warning was received he flew directly into a hurricane. Search for him since then has been in vain. Backed by Trans-American Air Lines Corporation, operating subsidiary of Thompson Aeronautical Corporation of Cleveland, this was scheduled to be the first of a series of monthly flights to study the possibilities of Arctic flying on year-round schedules. A Stinson monoplane has been made ready for the next trip. The Post Office Department had no part in Cramer's flight, but it, as well as the Canadian postal officials, was watching the development closely and wishing it well.

New airways are also the object of an African expedition being conducted by Sir Alan Cobham. In the World's largest float seaplane, the Short Valetta, powered by three Bristol Jupiter engines, he and a crew of two engineers, two photographers and a radio operator are investigating a trans-African seaplane route via the Congo River.

Calendar

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July 1-Sept. 8	Trans-Canada Air Pageant.
Aug. 29-Sept. 7	National Air Races, Cleveland Municipal Airport.
Sept. 1-3	Twentieth National Aeronautical Meeting, S.A.E., Hotel Statler, Cleveland.
Sept. 5-13	First Annual Air Fair, Binghamton, N. Y.
Sept. 11-13	Third Annual Air Races, Sioux Falls, S. D.
Sept. 12	Schneider Trophy Contest over Solent and Spithead.
Sept. 12-13	International Air Fete, Los Angeles.
Oct. 8-11	All Southern Aircraft Pageant, Charlotte, N. C.

Railroad turns airline operator

Eastern New England provides two significant airline developments for this reporting. The Boston & Maine and Maine Central railroads have entered the air passenger transportation business by sponsoring a service between Boston and Bangor, Me., and Pan-American Airways has inaugurated air mail between Bangor, Me., and Halifax, by way of St. John, N. B. The latter is being operated on a seasonal basis and will be suspended Sept. 30. Pan-American also takes the responsibility, by arrangement with the Boston and Maine, for the actual operations between Boston and Bangor.

Boston & Maine Airways, carrying passengers and mail (the latter by special arrangement with American Airways, which holds the contract) presents the first instance of direct sponsorship of an airline by a railroad, and climaxes a period of renewed interest in the subject on the part of the railroads, particularly the two leading systems in New England. While other roads have

been interested to varying degrees in airline projects, notably the Pennsylvania in Transcontinental & Western Air, none but the Boston & Maine has gone so far as to put its name on an airline. Flying time between Boston and Bangor is two hours, between Boston and Halifax six hours. Four planes leave Boston daily, one for Halifax, two for Bangor, one for Portland. Similar schedules operate southbound. Sikorsky S-41s are flown Boston-Halifax, tri-engined Fokkers on the other runs.

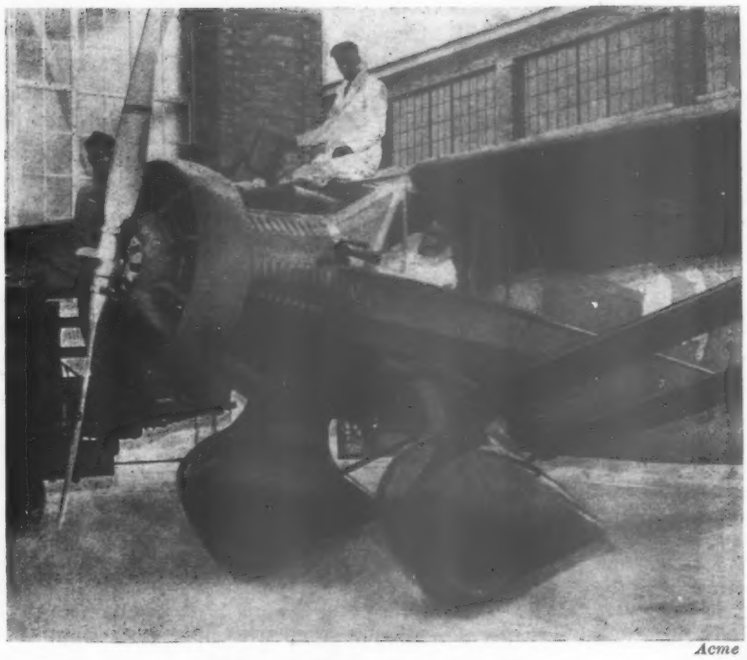
The Postmaster General announced on July 17 that bids for an air mail service between Bangor, the northern terminal of the Boston & Maine line, and Halifax would be opened ten days later, on July 27. The only bidder was Pan-American Airways, which received a ten-year contract at the rate of $2 per mile and opened service Aug. 1. Thus Pan-American acquires a foothold in the northeastern part of the country for eventual foreign mail service, comparable to its position in the southeastern section at Miami.

The Bangor-Halifax line may easily be the first leg in a future trans-Atlantic mail service by way of Greenland and Iceland, perhaps joining into the route flown for Trans-American Airways by Parker Cramer (reported on page 507). Pan-American is also likely to be the chief bidder for the New York-Bermuda contract when that is awarded, thus holding a leading position in plans for trans-Atlantic air mail service, whatever the route may be.

Independent operators register a protest

Dissatisfaction with the Post Office Department's methods of awarding new air mail contracts broke out into organized protest the latter half of July, following the announcement of sixteen new contracts, most of them awarded to subsidiaries of Transcontinental & Western Air, United Air Lines and American Airways. The Independent Air Passenger Association, including in its membership Bowen Airlines, Western Air Service, Pittsburgh Airways, Midland Air Express and Tuxhorn Airlines, was formed in Kansas City in July for the purpose of preparing a protest to the Post Office Department on its policy of granting contracts on new short lines to operators already holding contracts, without the formality of inviting bids. The protesting companies want all new mail routes thrown open to competitive bidding, especially if passenger services are already in operation.

Late in July this Association held a meeting in Washington and was joined by Continental Airways. No definite course of action was taken at that time. Century and Ludington, largest of all non-mail operators, have as yet taken no public part in these proceedings. In the meantime, Representative Kelly of Pennsylvania, author of the original contract air mail bill of 1925, has announced his intention of having the Post Office Committee of the House of Representatives make a thorough study of the results of the Watres Act during its first year of effectiveness. This will be independent of the investigation of air mail contracts which was authorized by the House Appropriations Committee, and which has been lying dormant during the summer.



Acme

RECORD MAKERS

Russell Boardman, John Polando and the Bellanca, which they used to fly to Istanbul from New York, establishing a new distance mark

New runs and an innovation

New services have been started by a number of lines. In accordance with the terms of the new mail contracts announced in the last issue, American Airways on Aug. 1 began mail and passenger service with Ford transports over the New York-Albany-Buffalo-Cleveland route. There will be one trip, each day in each direction. The through fare from Newark to Cleveland is $39.75, the elapsed time 6 hours, 45 min., the planes leaving Newark at 9:15 a.m. The regular night schedule between Albany and Cleveland by way of Buffalo for mail only will be continued. American Airways also opened the Fort Worth-Amarillo and Cincinnati-Cleveland services. Two mail and passenger trips are flown daily on the latter, with Fords.

Transcontinental & Western Air on Aug. 1 added two daily round trips between Pittsburgh and New York, by way of Philadelphia. This gives one morning and two afternoon planes each way daily between Pittsburgh and New York.

Transcontinental & Western Air introduced a novelty on Aug. 5, when it opened its overnight air freight service between New York and Kansas City, over its regular Eastern Division. Fokker F 14's (single-engined) equip the line.

The schedule is flexible, depending on the traffic and the weather, but with a deadline for acceptance of shipments and a definite objective of arrival of the planes at the terminal point by 7:30 the following morning. Should sufficient shipments be received to fill a plane in advance of the deadline, a machine will be dispatched at once, with the regular plane following later in the evening as a second section.

A 25-lb. package costs $2.90 between the terminals, a unit rate of approximately 24 cents per ton-mile, about twice the base rate for railway express. Shipments are limited to 200 lb. each and the rates are from airport to airport, not including pick-up and delivery. Postal Telegraph will furnish pick-up or delivery at the rate of 50 cents per package, and postal offices are equipped with Transcontinental & Western Air waybills.

Cargo insurance not exceeding $5,000 per package is available at the rate of $0.25 per $100. When the declared value exceeds $5 for any shipment, an additional charge of $0.05 is made for each $5, or fraction thereof up to $25, which is the ordinary limit of company liability. The rates are based on a package density of not less than 200 cu.in. per lb. Commodities lighter than that may be charged for by volume instead of by weight. Combined length

and girth of the package must not exceed 150 in., except by special arrangement.

The company is to concentrate its general offices and operating base at Kansas City Municipal Airport, where it will occupy a $100,000 hangar now being built by the city. The move from New York is to be completed by early autumn.

The excellent service being rendered by the Western Union and Postal Telegraph Companies through their ticket reservation and delivery service is being augmented by Western Union's arrangement for reservations by telephone without charge. Pennsylvania Air Lines have contracted for Western Electric beacons and broadcast receivers for its Cleveland-Akron-Pittsburgh-Washington line. American Airways is installing radio-telephone equipment on its Cincinnati-Columbus route.

Continental Airways is now using seven-place Lockheed Orions, with retractable landing gear, on its Chicago-Canton (Ohio)-Pittsburgh-Washington passenger service.

Airline reports

Scheduled airlines reported to the Aeronautical Chamber of Commerce a total of 42,928 passengers carried in June, 1931, as compared with 40,847 in June a year ago. Ludington Line established a new company record in July when it carried 6,044 persons between Washington and New York. It also carried 2,596 between Philadelphia and Atlantic City, and 479 on special charter trips.

The fate of the Canadian air mail still hangs in the balance. The flurry which in June accompanied the suggestion of general cancellation subsided somewhat when the government extended the present contracts to Aug. 15, the date set for announcement of a new policy. Probabilities are that at least the principal international services and the lines to remote areas having no other well-organized transportation will be continued undisturbed, although very likely at a reduced compensation for the contractors.

Airline inspection

Inspection of airlines under the Certificate of Authority plan has been accelerated by the employment of nine additional inspectors by the Aeronautics Branch, bringing the total up to twelve and by assigning them in teams to four geographical areas. Each of four crews of inspectors will be responsible for about thirteen airlines and divisions, except the Pacific Coast crew, which will supervise twenty.

A new airway direction device, known as a miniature radio range beacon, has been installed at Archibald, Ohio, 30 miles west of Toledo, for service tests. It is an auxiliary radio range station for use at the most important intermediate landing fields. It emits short-wave beams by which planes may find the field under bad weather conditions. During July the Aeronautics Branch, contracted for airway development work and supplies to a total contract price of $589,135.

Dissemination of weather intelligence on the airways is to be speeded up considerably by transmission of the standard daily weather map of the United States over the system. Eight ½-in. carriages are to be installed on the machines to permit insertion of the blank map. Symbols, words, and figures will be directly on the map in proper geographical location. Isotherms may be plotted from small dots.

Transmission of the entire map will take about seven minutes and additional information will require about five. It will be circulated twice a day, at 9:15 a.m. and p.m.

Airports on the increase

On July 15, there were 206 more airports and landing fields in this country than on the corresponding date in 1930. As of July 15, the Department of Commerce listed 577 recognized municipal airports and 601 commercial. California, as usual, heads the list with 169.

Shreveport, La., dedicated its new municipal airport July 14 and Vancouver opened its $600,000 municipal airport of 460 acres at about the same time. A seaplane port adjoins the field, and the hangar, 106x84 ft., is equipped to handle both landplanes and seaplanes.

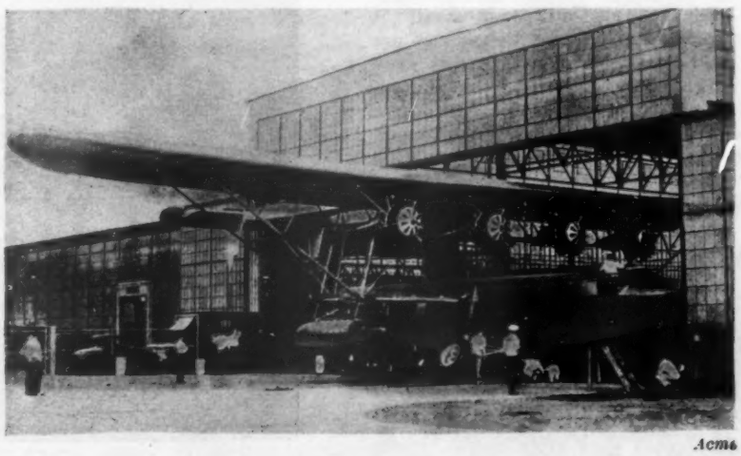
A map of New England, with the entire area divided into 20-mile squares, permits easy checking of distances between the various points, and estimation of the distance to the nearest airport at any time.

Plans for improvements at Le Bourget, to better serve commercial requirements, which would cost in the neighborhood of $5,000,000, are being seriously discussed in Paris. At the present time there are 162 airports in France and Algeria, but more than half of them are military and Le Bourget probably gets more commercial use than all the others combined.

British fighters

New high-speed fighting planes of the British Royal Air Forces which last month were put through their paces at the Hendon Pageant were among those occupied from July 20 to 23 with the grimmer business of the attack and defence of London. Twenty-five squadrons and one flight, a total of more than 250 planes, divided between "redland," the defenders of London and "blueland," the attackers, as well as searchlights and the observer corps, took part in the British Air Maneuvers, which more definitely simulated active service conditions than the Army Air Maneuvers over the east coast of the United States this past spring. Attackers flew in from the sea and in 59 out of 92 raids, made largely at night, were intercepted by defending planes, the other 33 being helped by heavy cloud layers to reach their objectives.

In a pouring rain on July 25, 40 planes took off from Heston Air Park to fly a 982-mile circuit of England in the tenth annual race for the King's Cup. Twenty-one successfully battled the weather for some twelve hours at average speeds of from 89 to 127 m.p.h. Flying-Officer E. C. T. Edwards, in Sir Robert McAlpine's Blackburn Bluebird LV was the first to finish and winner of the Cup on handicap, his actual speed 118 m.p.h. over the course. Second came Flight-Lieut. F. G. Gibbons in a Simmonds Spartan at an average speed of 109 m.p.h. while Lieut. Godfrey Rodd brought a D. H. Puss Moth in third in the handicapped race, but took the prize for the fastest actual



Acme

THE LARGEST DUCK

Sikorsky brings out the S.40 amphibion, a four-engined transport designed for a 40-passenger capacity

time, 127.5 m.p.h. average speed. The race was restricted to "amateur" pilots but that included the officers of the Royal Air Force, and the R.A.F. took the first three places and a good share of the other honors.

Race teams assemble

With the King's Cup Race a thing of the past, Schneider Trophy preparations monopolize British aeronautical interest. Both S-6 Rolls-Royce racing seaplanes have been delivered at Calshot air station, the training base for all three teams, where flight tests are being made which are expected to show the results of turning the engines up to 2,200 hp. The first contingent of the Italian team arrived on Aug. 12, with three training seaplanes. The remainder of the team, with the actual racing planes, were expected on the 26th. Trials over Lake Garda of a tandem twin-engined Fiat plane and a Macchi similar in design to the 1929 entrants, but of greater power, were reported. During the Lake Garda tests Capt. Giovanni Monti, member of the Italian team and veteran of the 1929 Schneider Cup races, while flying one of the training planes, plunged into the lake and was killed.

Accident has dogged the heels of the other teams as well. Flying one of the 1929 Supermarine S-6's Flight Lieut. Hope of the British team was forced by the loosening of part of the cowling on his engine to land in Southampton water, where the wash of a steamer sank his plane. Injury to his ear caused Lieutenant Hope to be replaced on the team by Lieut. G. L. Brinton of the Royal Navy. In a test flight at Caudebec one of the Nieuport-Delage practice planes of the French team was lost and Fernand Lasne, the well-known test pilot, had several ribs broken.

Though the completion of their new engines is by no means certain, the arrival of the French team, now training at the Berre naval station near Marseilles under Captain Amaurich, was expected at Calshot on Aug. 29. The racing monoplanes themselves are practically completed, but there is work still to be done in developing the inverted vee-type radium engine of the Lorraine company and an upright Renault, both of which are expected to develop about 2,300 hp. and to cool on ethylene-glycol (prestone).

Continental competitions

Air tours, of a more or less competitive nature, are being flown in almost every country of Europe. The Giro Aero d'Italia finished at Rome on July 26 after covering 3,650 miles in six stages. Anbrigui Colombo is the winner of a trophy presented by H. M. the King of Italy, and a cash prize of considerable size. His Breda 33, with its Gipsy III engine flew the distance in 35 hours, 35 min., 7 sec., an average of 102 m.p.h. Signors Meleri and De Angeli took the next places, both flying machines similar to the winner. In a "Grand Torismo" class, created to allow Puss Moth planes, just outside the regular weight limit, to participate, Capt. Hubert Broad of England and of the DeHavilland Company, was the winner, with a time of 37 hours, 42 min., 24 sec.

In direct contrast to the Giro d'Italia, in which pilots of several nationalities took part and where seven of the eight planes making the best showing were powered with Gipsy engines, a new French light plane competition, termed the Concours National Technique d'Avions de Tourisme, is limited to French firms entering planes made in France and manned by French crews. Held Sept. 23 to Oct. 11, it will include technical tests of climb, speed, maneuverability, and examination of the construction, comfort and safety of the plane, as well as a 2,250-mile tour about France. Planes entered must have folding or demountable wings, and special credit is to be given for the use of a heavy-oil engine of the diesel type.

Country clubs cruise New England

Probably the most successful tour ever organized exclusively for private owner-pilots was flown early in July by members of the Aviation Country Clubs. Any number of guests were permitted, the only specification being that the plane owner be present on all flights. The cruise, an invitation affair with no element of competition involved, started from the Seawanhaka Yacht Club on Oyster Bay with eleven planes, which flew west to circle Fort Hamilton and land for luncheon at the Timber Point Club at Great River, where two more planes joined them. The course then lay along the south shore of Long Island and across the Race of the Sound to Watch Hill, where the night was spent. Fog prevented the group, now fourteen in number, from reaching Nantucket, so they proceeded to Cotuit for the next night, then along Cape Cod to Chatham and back to Montauk on Long Island to disband. The schedule was easy-going, a casual cruise for a congenial group, with golf and swimming interspersed at the stops.

The Ford Tour

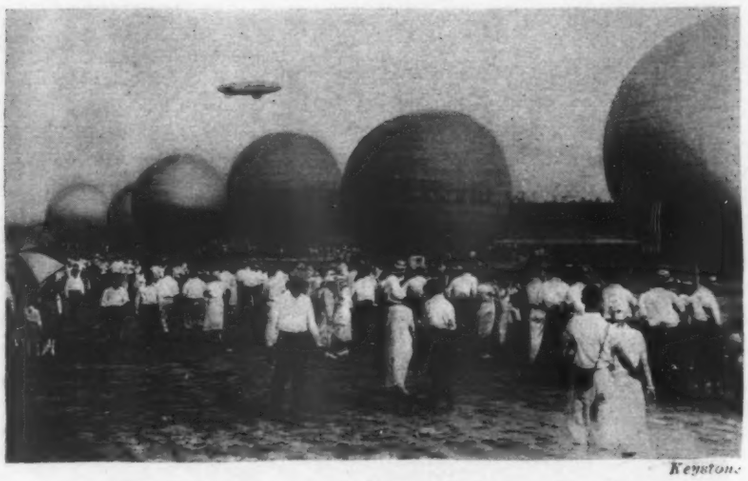
Starting from Detroit on July 4 with fourteen competing planes and ten accompanying, the National Air Tour returned 22 days later, with ten planes in the running, having covered 4,858 miles at average speeds varying from 64 m.p.h. for the Aeronca to 143 for the two Ford entries. The Edsel B. Ford reliability trophy, awarded on a point-score basis, goes to Harry L. Russell, last year's tour winner, who piloted a tri-engined Ford with Wright engines (two Whirlwinds and a Cyclone), while James H. Smart with a Wasp-powered Ford was a very close second. L. R. Bayles, flying a Granville Gee Bee, received the Great Lakes trophy for light planes, his average speed of 141 m.p.h. being better by almost twenty miles than that of any entrant except the two Fords.

Gliding and soaring at Elmira

The Second National Gliding and Soaring meet was held at Elmira, N. Y., August 2-16. Thirty-six pilots entered with 24 utilities and four sailplanes; three pilots met with serious injuries (one being injured twice) as the result

WAITING FOR WIND

Gliders at the Elmira (N. Y.) airport ready for soaring winds during the recent national soaring and gliding contest.



Keystone

AEROSTATS AT THE BARRIER

On the line at Akron in readiness for the annual National Elimination Race

of a spin, a side slip, a structural failure and a loose spin.

Weather conditions were unfavorable for the most part, but on Wednesday of the second week, Aug. 12, and on the last day pilots soared for 62 hours and 28 hours, respectively. At one time on the former there were thirteen pilots soaring at one time along the South Mountain ridge southeast of the airport, and on the latter there were seven. Total soaring time for the meet was 116 hours 46 min.

Albert Hastings retained the Edward S. Evans Trophy which he won last year and which carries with it the title of American glider champion. Martin Schempp, of Pittsburgh, was runner-up for this honor and won the prize for most hours in the air during the meet.

Schempp probably made a new American altitude record by reaching an indicated height of 3,130 ft. in a Haller sailplane. Other results were:

Altitude: Albert Hastings, Elmira, 1,960 ft.; R. E. Franklin, Ypsilanti, Mich., 1,300 ft.; Duration: Hastings, 7 hours 30 min.; J. H. Stickler, Washington, D. C., 7 hours 28 min. 5 sec.; F. K. Iszard, Elmira, 6 hours 3 min. Distance: Schempp, 15 miles; W. Hawley Bowlus, Leroy, N. Y., 12 miles; Hastings, 8 miles. Landing to the mark (on the Elmira airport from South Mountain): Edward Barton, Montour Falls, N. Y., 3 in. All but Schempp and Bowlus used Franklin Utilities. The duration and distance marks did not equal those of last year. Mrs. Russell Holderman, of Leroy, soared for 47 min., an unofficial women's duration mark.

One of the most important aspects of the meet was the conference Aug. 13 between Gilbert C. Budwig, chief of air regulations of the Aeronautics Branch, and representatives of glider pilots and manufacturers. Sentiment was strong for increased control of glider activities, particularly the conduct of training and inexpert manufacture of the craft.

The program of the National Air Races, commencing Aug. 9 and culminating in the Thompson Trophy Race on Sept. 7, contains many names familiar to the aeronautical world of both Europe and the United States. Ernst Udet, German ace and specialist in stunting low and slow, Flight Lieut. Richard Atcherley, British speed flier and exponent of "crazy flying," and Maj. Mario de Bernardi, veteran of the 1926 Schneider Cup race and official representative of the Italian government, are scheduled to compete, so will Maj. James H. Doolittle, whose reported retirement from air racing has apparently been postponed and who is expected to fly a special Laird. Special airport traffic rules for the period of the races will be more rigorous than ever.

Honors in the national balloon championship, started at Akron on July 19, go to Lieut. T. G. W. Settle, U.S.N., chief inspector on the construction of the U.S.S. Akron and frequent winner of such events. He had covered 215 miles among a succession of violent thunderstorms when he landed the big Navy bag at Marella, N. Y. Reward for this achievement is the Paul W. Litchfield trophy and the privilege of entering the international race. Rain and thunderstorms and the use of natural gas, with less than half lifting power of hydrogen, combined to reduce the winning distance less than half that made by Ward T. Van Orman, who sailed 562 miles to win the same honors last year.

Airships in the Arctic and at Akron

After a stop in Leningrad on July 26 for an extra supply of hydrogen, the Graf Zeppelin took off on the fourth lighter-than-air Arctic expedition in history (two of its predecessors ended fatally), carrying twelve scientists, a photographer, two journalists and a Russian wireless operator, besides a crew of 30. Almost two days later it landed in open water alongside the Russian ice-breaker Malygin in Pacific Bay, off Hooker Island, transferred 100 lb. of mail, then set off again towards the North Pole. Unfavorable weather sent the Graf back to Berlin with its cargo of photographs, arriving there in less than 30 hours.

Another step towards trans-Atlantic mail and passenger service is being taken at the Zeppelin factories in Friedrichshafen, where a huge new airship, the LZ-129 is under construction. Its gas capacity will be the greatest in the world, the cells being equipped to carry 7,063,000 cu.ft. of helium, 563,000 more than the Akron, which is 37 ft. longer and a little more than 2 ft. narrower than the new craft. Thus the tendency to steady reduction of fineness ratio is carried still another step.

For the present the U.S.S. Akron holds the title of the world's largest airship. Christened on Aug. 8 by Mrs. Hoover, it was to commence its flight trials about Aug. 25. Speed and altitude trials were to be conducted; turning circles and lift measured and various scientific data concerning the structural loads and the airworthiness collected and evaluated by the Naval Board of Inspection and Survey.

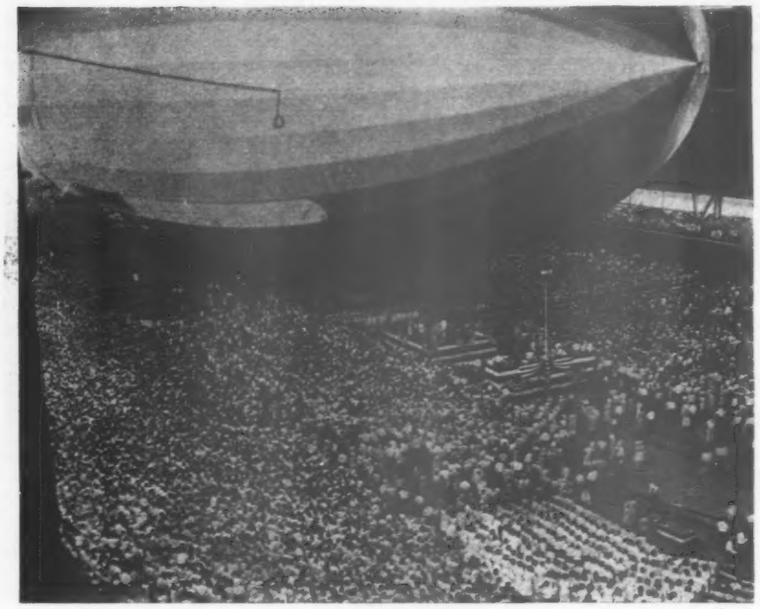
The Navy gets new equipment

Just a week before the christening ceremonies of the Akron legal title to 1,000 acres of ground at Sunnyvale, near the south end of San Francisco Bay, was transferred to the Navy for its base. The Navy Department has advertised for bids, to be opened the latter part of September, for a hangar to accommodate the new airship, and for other buildings necessary to complete the station. It will have the largest helium storage and repurification plant in the world, including a gas holder of 2,000,000 cu.ft. capacity. The hangar itself, designs for which have been completed by the Navy's Bureau of Yards and Docks, will be 1,138 ft. long, 310 ft. wide and 198 ft. high, and similar in general forward structure to the Goodyear-Zeppelin Corporation's hangar at Akron.

The Navy is also in the market for smaller items, such as airplanes and equipment. Contract has been awarded to the Consolidated Aircraft Company for 23 patrol flying boats and spare parts at a total cost of $1,709,827.50, or about $59,000 per plane. (The bidding for this order was summarized in AVIATION for August.) About $6,100 is the unit cost of 69 engines for the boats, which have been contracted for from Wright Aeronautical Corporation at a price, including spares, of $523,506.85. The Bliss company's low bid on engines of the Bristol Jupiter design

was passed over. The Keystone Aircraft Corporation is the recipient of a contract for seven Keystone-Loening amphibions, priced with spares at $164,062.50, of the same type as fifteen planes now being built by the Keystone company under previous contract. A two-seater biplane amphibion, designated by the Navy as the OL-9, is used for observation and general utility on aircraft carriers and at naval bases and cost about $18,750 per plane, not including spares, on the recent order.

An order has been placed with the Switlik Parachute & Equipment Company for 200 Safety Chutes for the Navy. Cotton cloth for parachutes, long a subject of research in an effort to free the military services from dependence on a foreign source of supply for raw silk, has been developed to a point where it almost meets Navy requirements. A new Bureau of Standards fabric is equal to silk in strength and tear resistance, closely approaches it in rate of descent and opening time, and increases the weight of the complete equipment only a pound or two. Increased bulk of the pack has been one of the greatest drawbacks of cotton.



Acme

CHRISTENED

The U.S.S. Akron, world's newest and largest exponent of lighter-than-air flight, officially receives its name at the Akron airship dock.

Navy expands

Navy plans for expansion of the aircraft establishment are developing. The thousand planes provided under the five-year program are considered as adequate for existing ships and shore stations. Henceforth the Navy Department wishes to increase the number to take care of new aircraft-carrying ships as they are launched, the authorization for each ship including the aircraft to equip it. Special interest therefore attaches to the Department's recently-announced building program, probably to be submitted to the next session of Congress, which includes two new aircraft carriers and one carrier-cruiser of the never-previously-existing London Treaty type. Furthermore, authorization will be sought for the early purchase of about 120 new planes to equip the aircraft carrier *Ranger,* now under construction. Net effect, if Congress and the President accept all this, will be to expand the Navy's air force from 1,000 to about 1,500 planes within the next four or five years, requiring total purchases, including replacements, of about 400 planes each year—somewhat more than the annual average over the last five years.

Attention of the Navy Department is now centered on providing for the study of designs for higher speed planes. The appropriation by Congress last July of $220,000 made it possible to take the first step, contracting for the development of a light weight, high-powered engine. Contract to the full amount of the funds available has been made with one of the largest engine manufacturers to undertake experimental work with water-cooled, chemically-cooled and air-cooled engines to develop power plant of 600 hp. or more. Further research is projected to determine the most efficient aerodynamic form and to develop an engine of over 1,000 hp., that the American service may keep abreast of the foreign developments along these lines.

Competition for the Do.X

The largest amphibion in the world, the Sikorsky S-40, recently received its water trials, and in its first flight test over Long Island Sound it took off with a gross load of 25,500 lb. in 16½ sec. It is powered by four P. & W. Hornet engines of 575 hp. each and will be flown as a flying boat over the Pan-American lines from Miami to the Canal Zone. It has capacity for 40. The maximum gross load will be some 34,000 lb. A second plane of the same design and for the same customer is in course of construction in the Sikorsky plant.

A duplicate of Frank Hawks' plane, the Travel Air Mystery S ordered for experimental purposes by the Italian government as the result of Capt. Hawks' high-speed visits to Rome during his recent European tour, has been completed at the Wichita factory. Commander Sbernadori, Italian aviation attache, tested and approved it for his government, which will soon be in possession of a craft which so far concedes equality in cruising speed only to five sister planes.

In line with its general policy of establishing factories and licensees in foreign countries, the Curtiss-Wright Corporation has announced new expansion in Europe and South America. The Aviolanda N. V. in Holland is building Curtiss Hawk pursuit planes, six of which have been ordered for the Dutch East Indies Air Force. These aircraft are also being built in Chile, and a new contract has been negotiated with the republic of Argentina giving it exclusive manufacturing rights for Whirlwind and Cyclone engines in that country. The government factory at Cordoba, heretofore producing Lorraine, Le Rhone and Hispano engines, will be devoted to the manufacture of the Wright engines, of which 250 are to be completed in the next five years.

Report has been made of the results of a special investigation of the Wright Aeronautical Corporation by a representative of the Department of Commerce at the instigation of Congressman La Guardia, former military aviator and always suspicious of the quality of American aerial equipment. The government inspector found no substantiation of the claim that rejected military parts were put into engines to be sold and operated commercially. He reported the company operating in full compliance with the terms of the approved type certificate and its system of inspection entirely satisfactory. This was the first special inquiry of the sort of which the results have been formally made public.

The N.A.A. convenes

In favor of the Navy program for high-speed development is the National Aeronautic Association, which held its tenth annual meeting in Washington July 23 and 24. Reorganization plans

suggested by the California branch in an effort to prevent the award of the National Air Races to Cleveland for five years in succession were not accepted. Resolutions for the expansion of the Army and Navy air forces and increased governmental aid to commercial aviation were passed, a banquet held at which the Loening Intercollegiate Flying Club Trophy was awarded, and most of the current officers, including President Hiram Bingham and Vice-President Amelia Earhart, re-elected.

At the time of the National Air Races a meeting on state aeronautical activities, called by Governor George White of Ohio and sponsored by the Aeronautical Chamber of Commerce, will be held in Cleveland. State directors of aeronautics, members of state aeronautic commissions and the aviation committees in the state legislatures will be invited. Two mornings, Sept. 1 and 2, will be devoted to discussion of uniform regulations to govern the licensing and operation of aircraft within state borders.

Regulations governing the manufacture of parachutes for the approval of the Department of Commerce are revised in a bulletin recently issued. The quality of fabric to be used, the type of suspension lines and the load tests which they are to withstand are more carefully described and circumstances which require separate approved type certificates for different models defined. Difference in size or shape of canopy and in type of fabric or harness is considered sufficient to warrant separate certification.

Corporation changes and reports

Consolidation of the Northrop Aircraft Corporation and the Stearman Aircraft Company, both subsidiaries of United Aircraft and Transport, will be completed by Sept. 1. All assets, equipment and engineering personnel of the Northrop company, manufacturer of all-metal low-wing monoplanes of novel and simple structure, will be moved to the new Wichita plant of the Stearman company, where both Northrop and Stearman planes will be made in the future.

Another new development within the ranks of United Aircraft is the consolidation, as a measure of administrative convenience, of the Boeing, National, Pacific, and Varney Air Transport Lines. The new corporation, United Air Lines, the largest airway operating company in the world, has 120 transport planes flying 31,100 scheduled miles daily: P. G. Johnson of the Boeing system is president, Chicago the central office.

Among semi-annual reports published recently is that of National Air Transport, Inc., now part of United Air Lines. Net profit for the six months ended June 30 was 321,253 after charges and taxes, or 49 cents a share on 650,000 shares of no-par stock. Earnings for the same period of 1930 were $347,226, 53 cents a share. Earnings for the second quarter of the year were 31 and 34 cents a share for 1931 and 1930 respectively. Operating ratio for the first half of 1931 was about 80 per cent as compared with 70 per cent for the same period last year.

Income of North American Aviation, Inc., including that of its wholly-owned subsidiaries, two of which are largely non-aeronautical, was $540,410 for the six first months of 1931, after expenses and federal taxes, or 25 cents a share on the non-par stock. In the first half of 1930 eanings were 47 cents a share, with a net income of $1,001,401.

Report of the Aviation Corporation of Delaware for the first half of 1931 showed a net loss of $729,480 after depreciation, as compared with loss of $3,236,318 in the same period last year. Before depreciation this year showed a profit of $39,621, against a loss of $983,076 in 1930. The improved situation this year is due principally to increased mileage on established routes and the effects of the Watres Act in increasing unit compensation rates on mail routes previously very unprofitable.

The company's average mail compensation rose from 45 cents a mile a year ago to 67 cents now, notwithstanding the general reductions which went into effect in April. American Airways, transport subsidiary of the company, received eight of the sixteen new routes granted by the Post Office Department on July 1.

The large extent to which its business is made up of government orders, continuing undisturbed through the depression, accounts for earnings by the Douglas Aircraft Company of no less than $1.21 a share on 341,734 shares of no-par stock outstanding for the first six months ending May 31, 1931.

Legal decisions

The material immediately following, together with references to legal and legislative matters elsewhere in the news pages, is based largely upon the Aviation Law Service prepared by the Commerce Clearing House, Inc. AVIATION is licensed to make use of this service, and is able to give its readers the benefits of the work of an organization specially trained and equipped to insure the complete collection of pertinent material on current legal developments.

The first aerial traffic summons in the history of Westchester County, N. Y., was served on Howard Kelly of Elmsford for violation of the regulation prohibiting low flying over inhabited areas. Complaint was made by a member of the Knollwood Country Club that Kelly had struck a flag pole on the club grounds.

Restrictions governing the use of airplanes before their certification for airworthiness are taken seriously in Canada. The Court of the King's Bench in Montreal has supported the refusal of Aero Insurance Company to be liable for an insured plane damaged before the certificate of airworthiness required for its use had been obtained. Application had been made to the proper authorities, but before the certificate had been granted the plane was equipped with pontoons and flown to a lake more than 75 miles distant, where it overturned and with the exception of the engine was completely destroyed. The owner contended that a temporary certificate obtained in the United States covered the situation, but since its time limit had expired and the craft had been converted from the landplane for which the certificate was issued into a seaplane the contention was overruled and recovery denied.

Florida, Pennsylvania, and Illinois have been added to the now almost complete list of states requiring federal licensing for all aircraft and pilots. Pennsylvania previously required a state license for planes and pilots. Now a Department of Commerce license is a prerequisite for state approval. Illinois in addition creates an Aeronautical Commission, composed of five persons, two of whom must be experienced pilots with at least 200 hours solo to their credit, to supervise aeronautical activities and facilities in the state. Airports, schools, and beacons, as well as pilots and aircraft, must have state certificates of registration the two last-named being exempt from the fees charged for this certification.

Personnel

J. S. Chick has been appointed director of sales for the American Eagle-Lincoln Company in place of E. E. Porterfield, Jr., former president of American Eagle, who recently resigned.

Emery Bronte, who flew to Hawaii in 1927, has been appointed National Aeronautic Association governor for California.

T. V. Van Stone has succeeded G. F. Vultee as chief engineer of the Emsco Aircraft Corporation.

Peter J. Brady has been named Deputy Commissioner of Docks in New York City in charge of Floyd Bennett Municipal Airport.

R. B. C. Noorduyn has resigned as vice-president and assistant to the president of the Bellanca Aircraft Corporation. W. B. Hurlburt, vice-president in charge of the New York office, has been made executive vice-president in charge of production, selling and service.

Brig. Gen. Benjamin D. Foulois, selected to succeed Maj. Gen. James E. Fechet as Chief of the Army Air Corps on Dec. 20, 1931, has announced that he does not wish to be considered for reappointment at the conclusion of his detail. This is in accordance with general precedent, to allow regular turnover in the combat branches of the Army.

Statistics of the Month

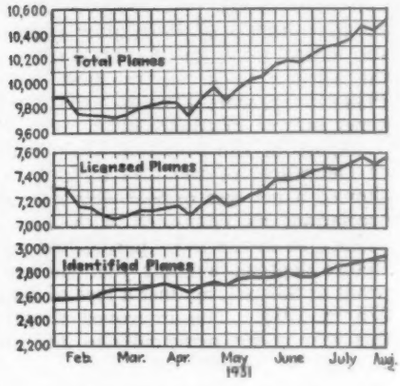
Material supplementing the statistical issue, AVIATION, March, 1931, appears regularly each month. Page numbers in the statistical issue are given.

PRODUCTION AND LICENSING

(Page 136)

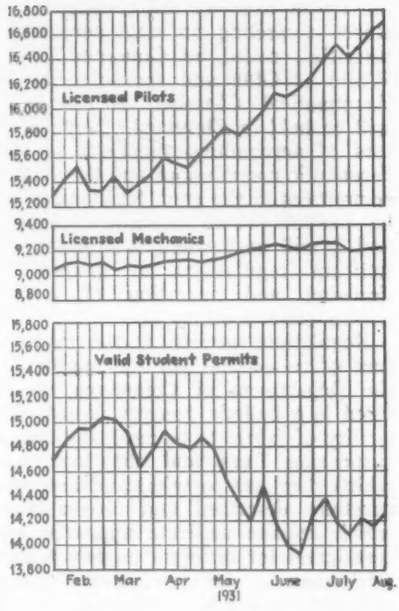
THE increase in total number of planes, commencing late in the spring, continues with undiminished speed, the slight decrease in total and especially in licensed planes the last week in July being about offset by the first August report, which reaches a new high point. Last year at this time the curve was quite different, no real recovery from the winter slump commencing until September. The rate of increase in identified planes has been practically stabilized at about 25 per week.

SYMMETRICAL to a degree unequaled by any of the other curves, that for licensed pilots has reached a new peak, 16,709. The total of legally approved fliers is about 3,000 in excess of the figure at the same date last year, an increase of more than 20 per cent. The curve for total number of student permits valid, after wide vacillations in the spring months, is showing a tendency toward stabilization at about 14,200. No comparison with last year is possible, since the figure for aspiring pilots is significant only after January first of this year.



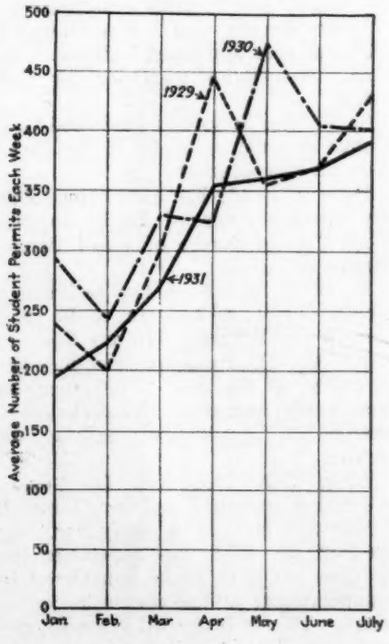
Valid airplane licenses and identifications

The weekly rate of issuance of student permits now compares more favorably with last year than at any other time since April, the only month when the 1931 figure has exceeded the 1930, the July average being within ten points of that for the previous year. The current weekly average of pilot licenses, on the other hand, continues to fall from 30 to 45 per cent below the curve for 1930.

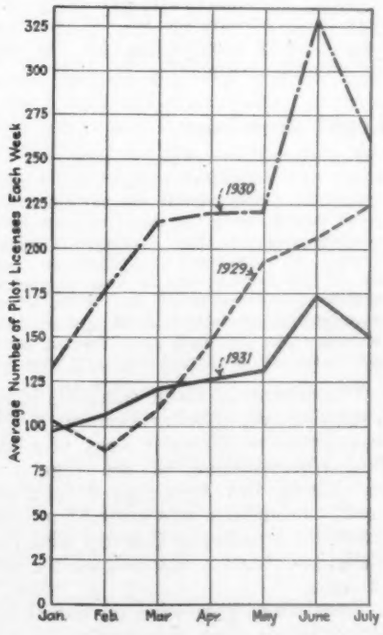


Valid pilot licenses, student permits in force and valid mechanics' licenses

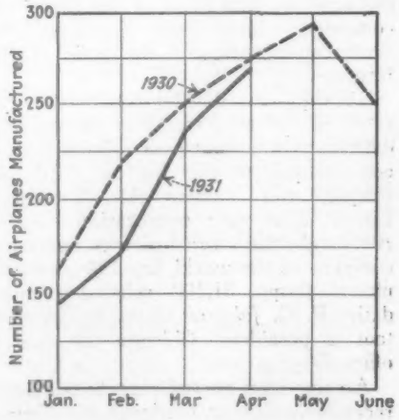
THE airplane production graph below is based on total production, as reported by the Aeronautical Chamber of Commerce. Planes for both civil and military production are included.



Student permits newly issued, month by month



New pilots licensed, month by month



Airplane production for 1930 and 1931

Contract Air Mail Carried, by Routes, First Six Months of 1931

	Miles of Service		Per Cent of Scheduled Mileage	Total Weight of Mail Dispatched (Pounds)			Average Compensation per Mile Flown	
	Scheduled	Actually Flown	Flown	1931	1930	Amount Paid to Contractor	1931	1930*
1. Boston–New York	120,462	106,420	88.4	65,897	59,275	$76,617.67	$0.72	$1.24
2. Chicago–St. Louis	195,008	181,562	93.1	34,936	27,216	110,005.38	.61	.56
3. Chicago–Dallas	897,388	805,147	89.7	255,870	204,445	613,951.36	.76	.91
4. Salt Lake City–San Diego	519,741	512,264	98.5	373,904	417,770	505,312.35	.99	1.71
5. Salt Lake City–Seattle	637,331	604,678	95.0	168,485	130,615	498,927.49	.83	.92
8. Seattle–San Diego	486,780	479,695	98.5	176,902	124,053	374,921.71	.78	.88
9. Chicago–St. Paul–Pembina	662,681	638,317	96.3	130,304	107,315	433,858.95	.68	.66
11. Cleveland–Pittsburgh	131,792	113,881	86.5	33,695	30,797	61,182.16	.54	.90
12. Cheyenne–Pueblo	73,848	70,272	95.2	35,668	41,843	45,236.85	.64	.57
16. Cleveland-Louisville (a)	126,094	111,864	88.7	30,160	36,234	83,074.16	.74	.46
17. New York–Chicago	949,610	787,385	82.9	836,406	809,141	705,921.91	.90	1.09
18. Chicago–San Francisco	1,936,853	1,902,669	98.3	934,189	926,031	1,877,135.03	.99	1.40
19. New York–Miami	1,327,239	1,229,976	92.7	390,438	213,765	811,228.65	.66	1.26
20. Albany–Nashville	215,891	196,626	91.2	43,627	31,698	135,807.96	.69	.36
21. Dallas–Galveston	120,546	113,230	93.8	18,840	18,272	69,312.35	.61	.49
22. Dallas–Brownsville	198,014	188,759	95.4	42,094	43,006	127,089.29	.67	.68
23. Atlanta–New Orleans	176,656	173,143	97.9	50,778	52,915	115,005.73	.67	.58
24. Chicago–Cincinnati	201,116	186,707	92.8	46,168	34,073	121,775.54	.65	.34
25. Atlanta–Miami (b)	285,163	258,838	90.8	88,786	88,407	157,891.44	.61	.52
26. Great Falls–Salt Lake City	273,473	267,174	97.6	29,559	29,606	162,770.98	.61	.46
27. Bay City–Chicago	516,720	475,561	92.0	88,315	87,773	275,049.40	.58	.48
28. St. Louis–Omaha (c)	216,706	199,847	92.2	60,534	81,632	55,087.25	.28	.25
29. New Orleans–Houston	116,570	116,491	99.9	25,701	25,203	45,885.14	.39	.23
30. Omaha–Atlanta	454,000	418,037	92.2	102,837	57,804	286,627.41	.69	.20
30. Kansas City–Denver (part) (d)	28,288	28,288	100.0	2,578	.....	11,315.20	.40	....
33. Atlanta–Los Angeles	882,472	817,254	92.6	104,357	.....	717,663.28	.88	....
34. New York–Los Angeles	1,395,726	1,210,828	86.8	166,650	.....	681,607.54	.56	....
All routes	13,146,168	12,194,923	92.8	4,337,678	3,761,911	$9,160,260.66	.57	.88

* Rate for whole year. (a) Consolidated with Route 20, May 15, 1931. (b) Consolidated with Route 19, April 1. (c) Consolidated with Route 30, May 15, 1931 (d) Service between Kansas City and Denver inaugurated June 5.

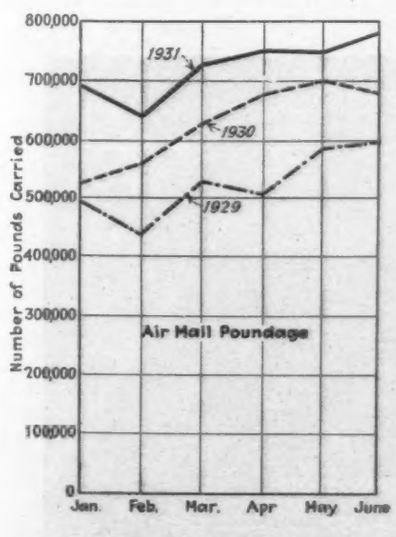
AIR MAIL AND TRANSPORT

(Page 153)

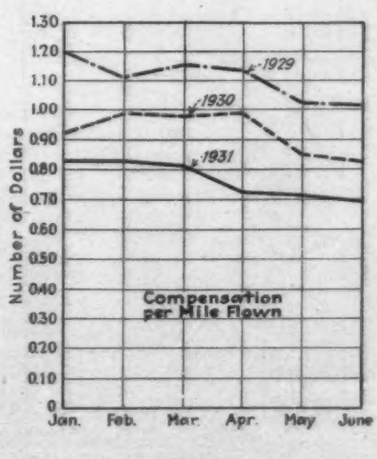
REPORTS on scheduled air transport operations from both the Department of Commerce and the Aeronautical Chamber of Commerce show the first half of 1931 well ahead of the same period of 1930 in all but one branch of operations. Passenger traffic, indicated by passenger-miles and reported only by the Aeronautical Chamber, shows a decrease of about 3 per cent due to poor reports for the months of April and May of this year. In June the number of passenger-miles flown again exceeded the 1930 figure. Scheduled mileage and mileage actually flown in the first six months of 1931 on contract air mail routes exceeded by 60 and 62 per cent respectively the accomplishments of the preceding year. The greatest distance flown was on route 18, between Chicago and San Francisco, which accounted for almost 16 per cent of the total air mail mileage. Route 19, extended from Atlanta to Miami at the beginning of the second quarter, and the new New York-Los Angeles route were close competitors for second place with about a tenth of the total mileage each.

Rate revisions under the authority of the Watres bill have made a great change in the picture of average compensation, bringing the 1931 curve well below those of the preceding years as well as reducing the variation in compensation among the various operators. Average compensation per mile flown during the twelve months of 1930 ranged from $1.71 on the Salt Lake City-San Diego route to 20 cents on route 30, then operating between Chicago and Atlanta, a difference of $1.51. The variation in 1931 was but 72 cents in the most extreme case, the St. Louis-Omaha route which has since been consolidated with route 30 receiving on the average 28 cents per mile flown while routes 4 and 18 were paid 99 cents. In 1931, however, no route received more than this last-mentioned figure and only three, including the newly established Kansas City-Denver extension, received less than half a dollar. Five routes were paid more than a dollar per mile in 1930 and nine less than 50 cents.

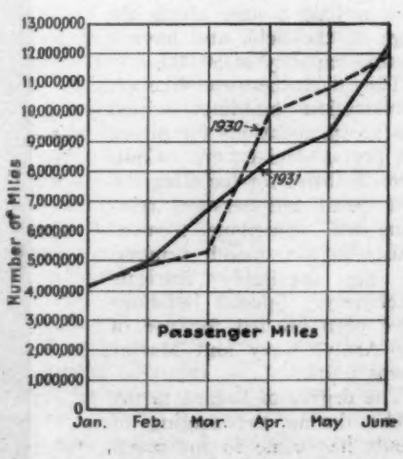
The curves for mail poundage are in almost complete reversal of those for compensation, the general direction being upward and the course invariably 10 to 20 per cent above that of the preceding year. Total weight of mail dispatched during the first half of 1931 was 15 per cent greater than during the same period of last year, slightly more than a fifth being carried over one route, that from Chicago to San Francisco. The New York-Chicago route was a very close second, however, responsible as it was for 19 per cent of the total mail poundage.



Total mail dispatched



Air mail compensation



Passenger transport operation

Setting the stage for the Races

The eleventh annual meet of the series is to have an elaborate background

THE curtain is about to rise on the eleventh National Air Races —Aug. 29-Sept. 7. Experience, a heavily financed organization, and the arrangement making the event a permanent Cleveland institution for at least five years are making possible the most eleborate background of the series. Most of the individual events will differ little from those which have been most successful in the past, but a number of the refinements are noteworthy. Cash prizes total $100,000 this year, and a number of trophies are offered, also.

One of the largest single innovations will be the group of permanent wood grandstands and race administration building which have been installed on the west side of the Cleveland Municipal Airport. These structures are expected to give the races something of the atmosphere of such perennials as the Indianapolis speed races and the Kentucky Derby. The grandstands extend a half a mile along the edge of the field, and have a seating capacity of 50,000.

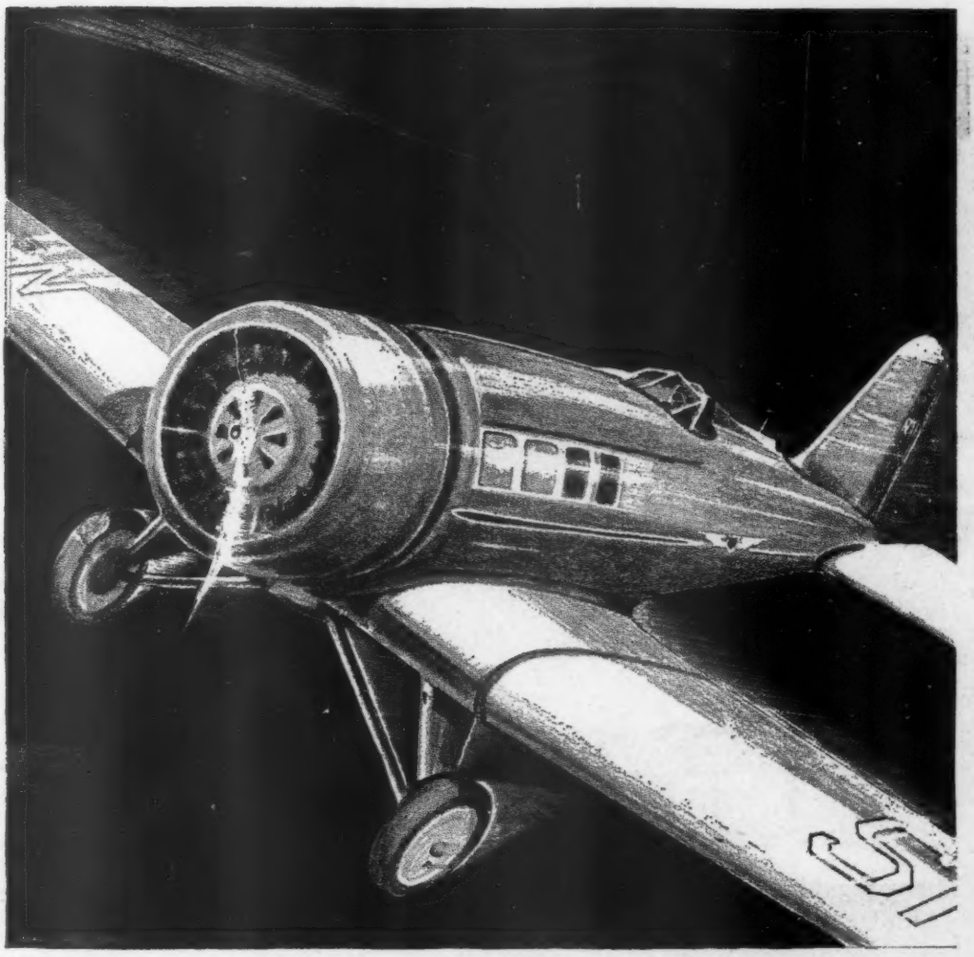
They flank the tower-like administration building, which has accommodations for pilots, the press, officials, etc. Complete facilities for handling the vast detail and personal relations will contribute tremendously to the smooth running of the inevitably intricate machinery. Special buildings have been erected for use of the Army, Navy and Marine Corps units.

The degree of hazard to the public during the staging of events has come in for much censure during the last two years, and it is gratifying that a re-location of the 5-mile and 10-mile closed courses has been made by the management to lower the danger. Where previously the racing planes on at least one leg were forced to fly directly toward or actually over a part of the spectators', space, this year's course places the stands and building *within* the kite-shaped course (instead of opposite one apex) with the key pylon directly in front of the stands. Thus the machines will fly past the spectators' area, but not over or toward any part of it. Under no circumstances will planes take off over the stands. [See the diagram for the schematic layout.] The racing planes will pass to the rear of the stands on the further reaches of the course and so will be entirely removed from the airport except when passing the home pylon and the zone reserved for them.

This accomplishes another objective, also. It permits the management to draw a distinct white line through the center of the effective landing area of the airport, and designate the area to the west of it for racing purposes, that to the east strictly for regular commercial activities and the arrival and departure of aircraft incidental to the meet. Special traffic rules approved by the Aeronautic Branch have been drawn up to control all flying within the airport vicinity.

The Thompson free-for-all on Labor Day, Sept. 7, again promises to be the speed climax of the program. As in the last two years, the commercial entrants hold the limelight, this year's entries including, among others, James Doolittle, Lowell Bayles in a new special Gee Bee low-wing racer, and Alford Williams in his streamlined Curtiss Falcon. The

SCENE OF THE 1931 NATIONAL AIR RACES AT CLEVELAND



Cleveland Pneumatic Aerol Trophy race, the women's free-for-all speed event, will be flown Sept. 4.

Of special interest will be the new events for autogiros. The trans-continental derbies have been consolidated this year to two events—a trans-continental free-for-all which must be finished at Cleveland by 7 p.m. Aug. 31, the same day as the take-off from Los Angeles, and the so-called National Sweepstakes Handicap Race, with men's and women's divisions, which will start from Santa Monica, Aug. 25, and end at Cleveland, Aug. 30.

Thompson Trophy race entrants must qualify in trials over a mile course with a speed of at least 175 m.p.h. A speed of at least 140 m.p.h. will qualify women pilots for the Cleveland Pneumatic race in similar trials. These mile speed dashes are a new feature and will be staged for various classes of planes in addition those entered in the specific events mentioned above. They should prove particularly interesting to the general public. Another feature with much public appeal will be the night flying exhibitions.

There will three classes of races: Events for planes having approved type or Group II certificates; free-for-alls in all announced commercial competitive groups for experimental planes; and events for approved type craft flown by non-professional pilots. There are subdivisions in each class for women. Thirty-six naval planes (including twelve flying boats), the same number of Army machines (augmented on Army Day, Sept. 1, by 36 pursuit planes from Selfridge Field), the dirigible Akron and a group of stunt pilots from Europe will add their color. Racing pits, tried out successfully at Chicago last year to permit closer public view of the planes, will be used again. They are located in front of the stands.

As we go to press a total of 40 entries had been received.

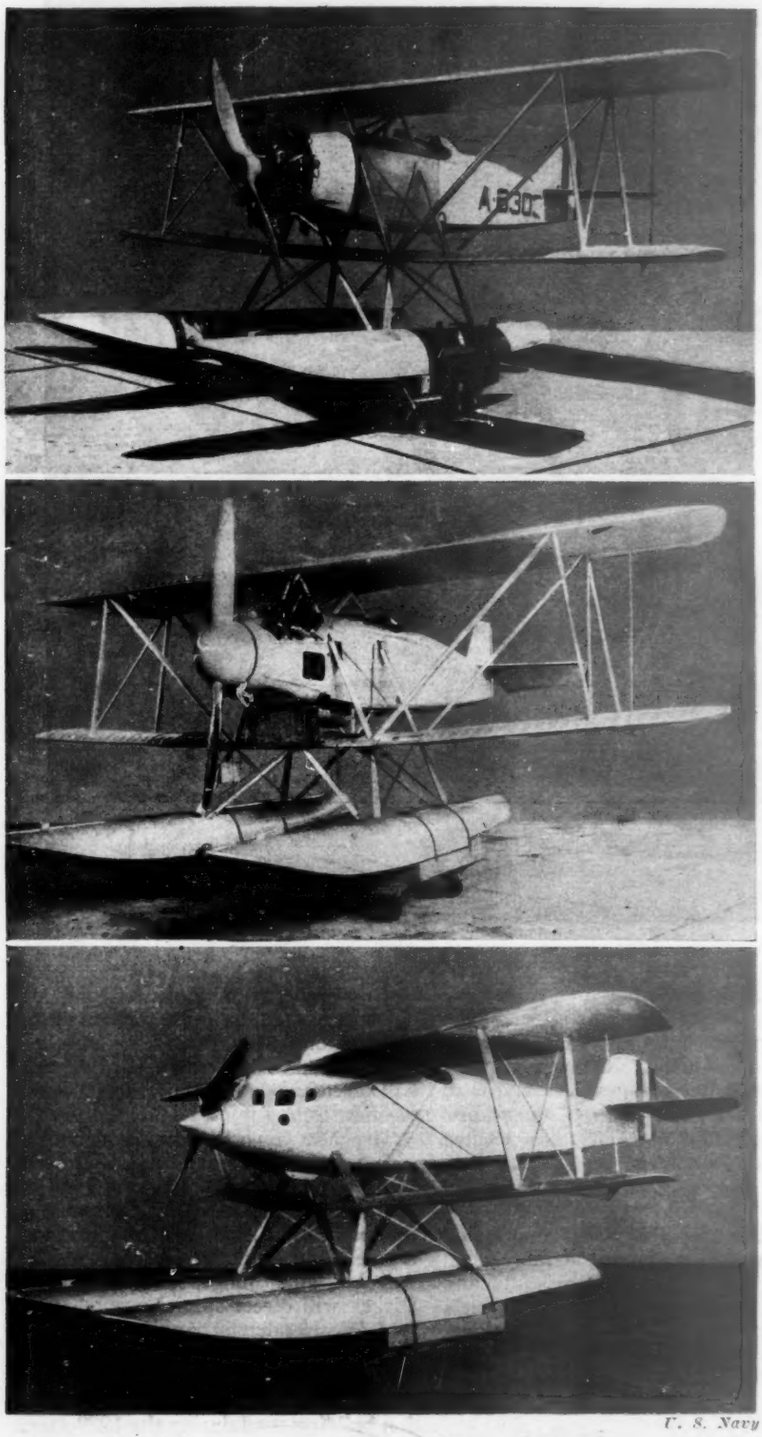
Realizing that the public impression of the meet depends considerably upon the ease of ingress and egress to and from the race area, the management has made extra precautions this year to provide adequate traffic channels. Certain highways between the port and the downtown area have been marked for one-way outward traffic only and others for inward. The 80-acre parking area will accommodate about 30,000 automobiles.

The most important single committee—the Contest Committee—is headed again this year by E. W. (Pop) Cleveland. E. V. Rickenbacker will assist as referee, Maj. E. H. Zistell, commander of the Ohio National Guard squadron, will be chief judge, and Samuel S. Dickey will direct special events. Clifford W. Henderson continues as managing director and Clifford Gildersleeve is executive vice-president. Contest headquarters will be in the administration building used during the 1929 races. Judges, timers, scorers and race control officials will be housed on the fifth floor of the new administration tower, executive offices will be on the third floor, and the second will be devoted to a restaurant.

The twentieth national aeronautical meeting of the S.A.E. will be held Sept. 1-3, and under the auspices of the Aeronautical Chamber of Commerce there will be meetings of transport operators on Sept. 1-2, of state aviation commissioners on Sept. 1, and of engine manufacturers on a day undetermined.

Air Race Calendar

Aug. 30 — Arrival men's and women's divisions trans-continental handicap derby.
Aug. 31—Start and finish of the trans-continental free-for-all.
Sept. 1—Meeting of state aviation commissioners.
Sept. 1-3 — Twentieth National Aeronautical Meeting of the S.A.E.
Sept. 1-2 — Transport operators' meeting.
Sept. 4—A.S.M.E. Technical Session at 9:30 a.m.
Sept. 4 — Cleveland Pneumatic Aerol Trophy Race for women.
Sept. 4—Air transport and efficiency contest.
Sept. 7—Thompson Trophy Race. Air transport speed and efficiency contest.



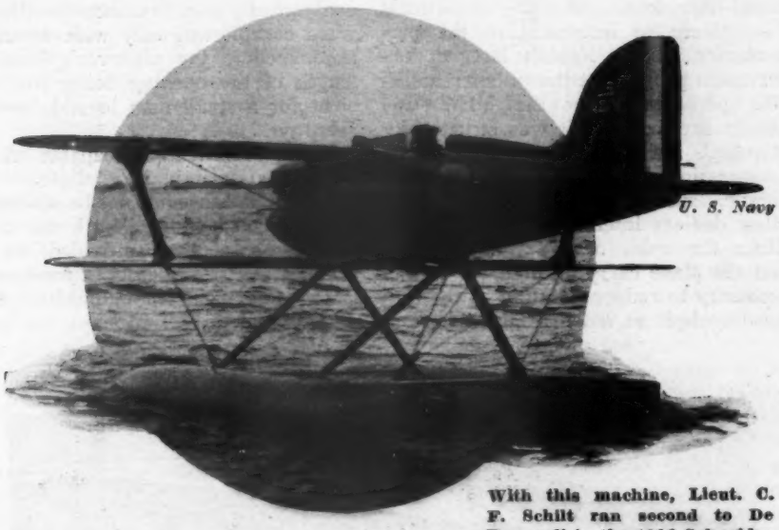
U. S. Navy

Pursuit plane into racer. These three photographs show three transition stages in the development from an air-cooled fighter, to a water-cooled racing plane. The first photograph is of the TS fighter, the second shows the same plane provided with a water-cooled engine and standard tubular radiator, and the third, a typical racing plane with well cowled water-cooled engine, wing radiators and lowered upper wing, all items intended to eliminate drag.

By
John S. Kean
Naval Aircraft Factory

RACING planes, either as modifications of existing types, or as new designs, bring to the attention of the aeronautical industry the very elements which must be developed if the airplane is to assume its logical place in the transportation field. The gradual transition of the fast plane from a purely military to an essential commercial development is one of the important contributions of the past few years of racing. In the not far distant past, races in which military planes were pitted against privately owned machines, ended invariably in a victory for the former. The winning of the speed events of the National Air Races of 1929 and 1930 by privately owned planes of non-military designs, and the advent of production models of numerous commercial planes with speeds equal to or greater than the best performance of the military planes is a healthy indication that the value of high speed is appreciated in the industry. At the same time it must be realized that the design of military planes is predicated on features, such as maneuverability and climb with military loads, with which the commercial industry is scarcely concerned.

The War was responsible for a type of plane designed for high speed, which was destined to become a veteran as a racer—the Curtiss 18T. The type was designed in the final days of the World War as an answer to the threat of the Fokker pursuits then being used effectively by the Central Powers. As a fighting plane, the relatively poor vision afforded by the tri-plane structure was a disadvantage, but as racers these planes were truly pioneers. They incorporated the multi-spar wing construction still current in racing plane design. The last of these planes came to grief during the Curtiss Marine Trophy



U. S. Navy

With this machine, Lieut. C. F. Schilt ran second to De Bernardi in the 1926 Schneider

Racing seaplanes

A designer's experience with their development in the United States

The evolution of racing machines always involves much the same problems. Although American experience in international racing was broken off in 1926, essentially the same difficulties described by Mr. Kean in the light of American experience are still being encountered by the British and other European teams in preparation for this year's Schneider Race. To secure the nearest possible approximation to a perfect unbroken streamlined form in spite of the presence of pilot and engine—to find a fuel and system of cooling that will permit the development of maximum power for one hour—to raise the engine power to a maximum possible figure—to use the thinnest possible wings and a minimum of external bracing and yet to guard against wing and control flutter—those are still the essentials. Mr. Kean explains the method of approach to a solution.

Races for seaplanes in 1922, at Detroit where Lieutenant Sanderson, U.S.M.C., while leading the race and on the final lap landed his plane spectacularly atop a coal pile when engine failure occurred while he was over land.

Marine trophy races of 1922

These Detroit races were, to the knowledge of the writer, the last in which any real water performance was required. The "navigability tests" of the Schneider, performed in smooth water, are so simple as to be almost negligible. The 1922 Curtiss Trophy race, a free-for-all for any type of seaplane or flying boat with a speed in excess of 70 m.p.h., included a requirement that during the course, the pilots land, turn, and taxi for a certain distance; turn, take off, and finish the race. But two planes finished, a TR-1, manufactured by the Naval Aircraft Factory with a speed of 112.6 m.p.h., and a Vought VE-7, with a speed of 109 m.p.h. Both pilots put up remarkable performances not only in the air but in the rough water of Lake Michigan, across which half a gale was blowing. In defiance of all the edicts regarding drag and methods of overcoming it, no fairing or "dressing up" of the VE-7 was attempted. The bracing wires, for example, were of unstreamlined cable.

There was one entry in this race, however, which gave evidence of care in design looking toward decreased drag and hence increased speed. It was the original Vought UO-1, the first, literally, of hundreds of planes of that model which, equipped with engines of the familiar Whirlwind type, were for a number of years the standard observation planes of the Naval service. Unfortunately the UO-1 plane was not flown in the race due to defects in the location of the wing tip floats which rendered it unstable and uncontrollable on the water. Otherwise, an interesting comparison between a standard and a "dressed-up" service plane would have been possible.

Developments of 1925

An opportunity for such comparison did present itself three years later, in 1925, when a VE-7, modified for racing purposes, was flown in the Liberty Engine Builders' Trophy Race.

American engineers visiting the Na-

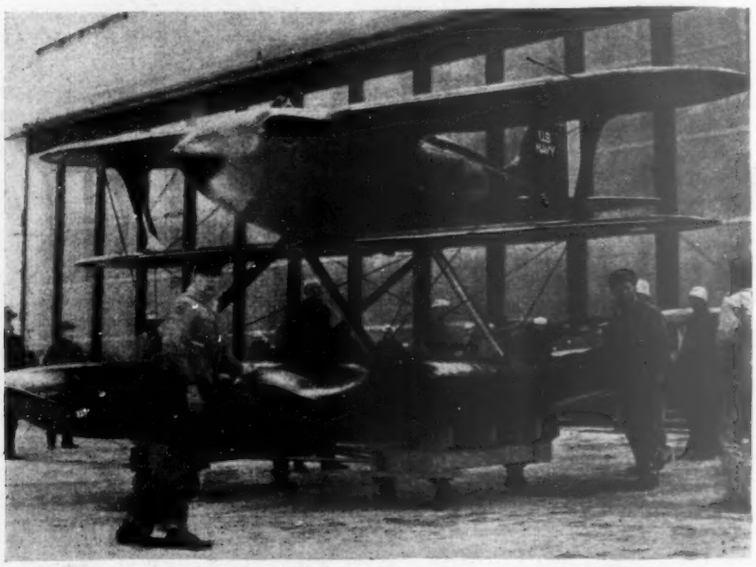
tional Air Races of 1925 at Mitchel Field were so interested in the performance of the French Breguet observation planes that the rather remarkable performance of the VE-7 was almost overlooked. It was structurally standard, but was fitted with a high compression Wright E-4 water-cooled engine, special cowling and various other devices intended to reduce drag. Since the rules of the race required that the plane carry an observer it was necessary to reduce the drag of the forward cockpit as much as possible, and consequently the entrance to the forward cockpit was only wide enough to accommodate the observer's head, the length of the opening being just sufficient for a small man to slide through sideways.

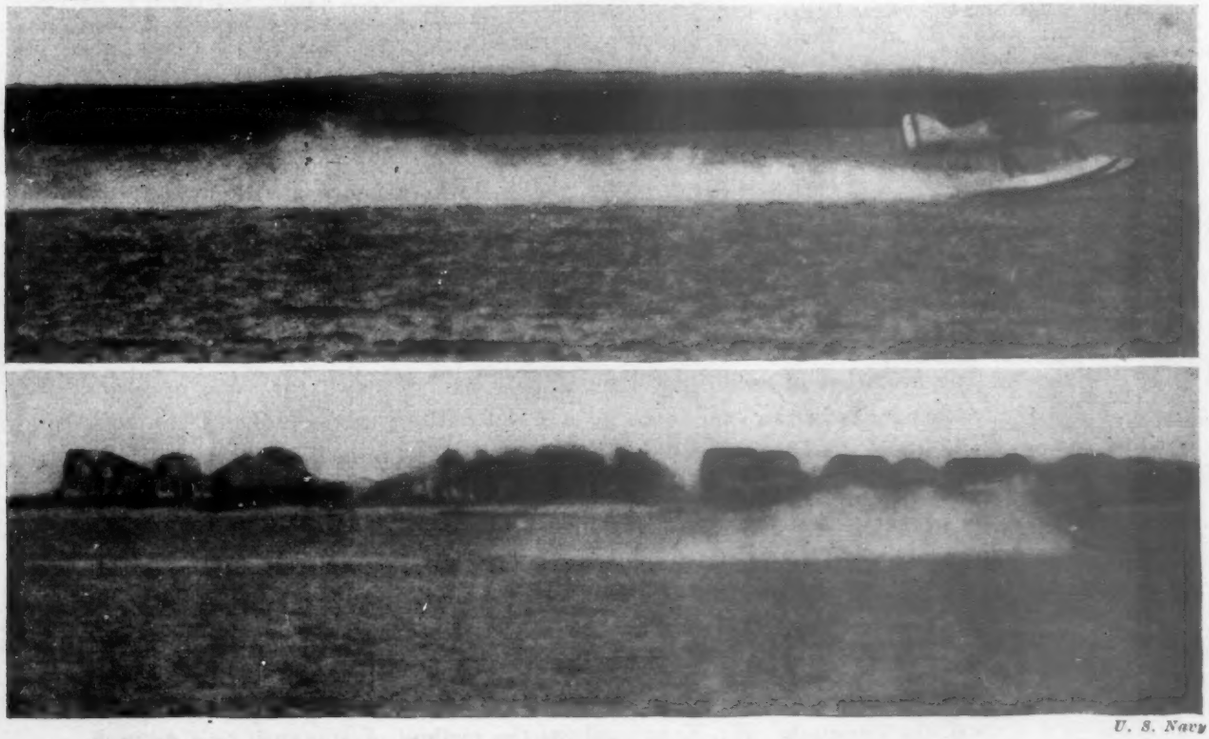
This machine was capable of 143 m.p.h. in straightaway flight. Such speed could, however, not be maintained for any considerable length due to the inadequate cooling provided by the standard VE-7 radiators, a foretaste, at least, of some of the difficulties to be encountered in all attempts to attain higher speeds by increase in the power, particularly by increase in compression ratio. The gain in speed in this case was about 25 m.p.h. over the standard VE-7, (143 as compared to 118), while the increase in power amounted to 40 hp., (260 hp. as compared to 220 hp.). The increase in power alone would have accounted for a gain of about 9 m.p.h.

The Schneider racers

The year 1926 brought the last real speed event of American aeronautics—the Schneider Trophy Race—and the victory of the remarkable Italian monoplanes. The American team of that year seemed dogged by misfortune, including the loss of two pilots, the wrecking of one racing plane, and the serious damaging of another, all while preparing for the race.

The American entries were three biplanes, all different in detail but all based on the original Curtiss racing planes built for the Pulitzer Cup Race of 1925. The R3C2 plane was entered without modification except such as was incidental to the installation of the float type landing gear. Flown by Lieut. C. F. Schilt, U.S.M.C., it finished second to De Bernardi's Macchi monoplane. During the race one of the wires bracing the wing to the float carried away at the lower end and, dangling loose from the wing at 230 m.p.h., introduced so much wing and aileron flutter as to make the plane almost uncontrollable.





U. S. Navy

R3C3 plane (see page 521) for the 1926 Schneider. Top to bottom: Warming up; Two minutes later (note the heavy wake, much worse than that of the Italian planes with their more sharply vee-bottomed floats); Ten seconds later.

Lieutenant Schilt, however, succeeded in keeping the plane in the air to finish second in spite of the physical effort required to restrain the rapidly vibrating control stick.

The R3C3 plane, in which the writer was particularly interested, was wrecked the day before the race when it turned turtle in a practice landing. It was probably the most promising of the American entries, at least until entirely unexpected difficulties arose during test flights. On one test it exceeded the speed later set as a world's record by De Bernardi's Macchi monoplane, the winner of the race.

The ill-fated R3C3

The most interesting feature of the reconstruction of the R3C3 from the R3C2, was the use of a geared Packard high compression 1A-1500 engine. The gears and gear case were designed to raise the propeller axis to approximately the center of area of the fuselage, making it possible to construct an almost symmetrical engine cowl, a practice known to result in marked decrease in drag and hence increased speed. The engine mounting was a monocoque structure, since because of the low position of the engine with reference to the fuselage, sufficient space to accommodate the normal tubular mount was not available. The mounting was attached to the fuselage by multiple rivets at the fire wall.

Although the installation was not satisfactory from the standpoint of accessibility, the completed structure was a splendid example of the cleanness of design desirable in high-speed planes. The engine fitted so tightly in the cowl that it could not be installed with the water pump in place. The latter was removed and laid in approximately the correct position in the bottom of the monocoque structure. The engine was then brought into place over it and, working through a small hand hole in the bottom of the mounting, the installation was completed. Difficulties of this nature are, of course, not desirable in ordinary practice, but in the case of racing planes they are acceptable if the cleanness is improved.

In this machine a serious effort was made to reduce the drag caused by the open cockpit, as this item is responsible for a considerable portion of the resistance. At the high speeds involved it would probably result in the sacrifice from 2 to 3 per cent of the speed. If this figure should appear insignificant, it must be remembered that we were dealing with speeds expected to be about 260 m.p.h. of which 3 per cent was 7.8 m.p.h., the utilization of which might readily mean the difference between victory and defeat.

It was realized that while the drag of the cockpit and windshield could not be entirely eliminated, the drag could be much reduced by closing up the opening around the pilot's shoulders as much as possible. To this end the windshield was carried well aft while permitting sufficient space for the entrance and exit of the pilot. Racing planes normally have hinged sections of cowling which are installed after the pilot is in place and which close in the opening around his shoulders. These portions are fastened with a latch which is fitted with a release device by which the cowling may be released in case of emergency. For this plane, however, it was decided to carry this idea one step further and to fit cowling around the pilot's neck so that his shoulders would be covered, thus almost completely closing the cockpit. So that a stiff section of metallic cowling would not bear on the pilot's shoulders, a broad section of elastic webbing was fitted to that portion of the cowling in contact with the neck and shoulders so that his head only emerged, turtle fashion, from the cockpit.

The wind shield was made to serve a dual purpose. Its frame work contained the expansion tank of the cooling system, usually installed above the engine outside the cowl lines. This effectively killed two birds with one stone, as an additional deviation from a true streamline form to suit the expansion tank was avoided.

The R3C3 was exceptionally interesting from the standpoint of design and construction and gave every evidence of amply fulfilling the optimistic expectations regarding its high speed. Test flights, however, brought out difficulties which were insurmountable. The most serious defect arose from the fact that the propeller direction was reversed as compared to normal planes. This produced a propeller torque which tended to yaw the plane to the right, and it was necessary for the pilot to constantly carry left rudder. This peculiarity, was of course, of an opposite sense as compared to the normal plane, in which the pilot carries right rudder to prevent yawing to the left, but the effect was heightened by the gearing of the engine, which increased the torque reaction. Although an offset fin had been fitted to correct the yawing tendency to some extent, psychological effect on the pilot was bad. The "mental hazard" was too serious to overcome in the short time available for test-flying this plane. [This large propeller torque, even though it be in the normal direction, has continued as a serious affliction on racing seaplanes. To overcome it, one of the Italian machines for this year's Schneider Race was designed with two propellers in tandem, very close together and rotating in opposite directions.—Ed.]

Another effect of the increased torque was the difficulty of water handling. The first flight indicated a marked tendency of the plane to bury the right wing very nearly up to take-off speed. In order to correct this defect, the pilot had to use considerable left rudder, which increased the drag so that the plane accelerated very slowly and was difficult to get on the step. Great masses of water were thrown up by the buried right float and caused serious water beating damage to the propellor. These defects were studied, but could not be remedied at this time. As a matter of fact, it was not until the tests of the Mercury Racer of 1929 were under way that simple methods of correction were worked out.

The career of the R3C3 came to an end when in making a practice landing in the wake of a bombing plane, the plane turned turtle. At that time the real disadvantage of the tight fitting cowl was very much in evidence, as the pilot while submerged in the cockpit was forced to fight his way out of the encircling cowl. This incident marked the definite termination of the writer's interest in such "gadgets" as necklace cowling.

Many of the difficulties of the R3C3 plane were experienced in later planes. While testing Lieutenant Williams' Mercury racer, intended for the Schneider Trophy Race of 1929, the same tendency to bury one wing was noticeable while taxiing at speeds somewhat below "hump" speed. In this case the use of the rudder and ailerons introduced drag loads of such magnitude as to prevent getting on the step. As a last resource it was decided to try to keep the controls neutral, and it was found that as the plane approached the "hump" speed it would right itself to an even keel, due apparently to the reaction of the water on the bottom of the submerged float.

It was found also that the propeller damage was caused by a surge of water which flooded the deck of the float in landing, or when the engine was throttled after a taxiing run on the water. To overcome the trouble the pilot "cut the switch" so that when the surge washed through the propeller, the latter was stopped, or turning very slowly. It is interesting to note that the English had the same experiences in the case of the S-6, and after numerous expedients were tried adopted the same corrective measures.

Ring cowling possibilities

In conclusion it might be pointed out that recent experiments with devices such as the Townend ring or modifications thereof offer hope that such devices may be effectively used to reduce the drag, not only of air-cooled engines, but also of other portions of planes now contributing seriously to the drag—such as wind shields and the juncture between body and surfaces. Investigation in this field will well repay designers of future racing planes.

Class C (Airplanes) Returning to departure point without refueling

Kg. payload	0		500		1,000	
	World	American	World	American	World	American
Duration (hr., min., sec.)	United States 84:32:00 Bellanca Packard diesel 225 hp.	84:32:00 Bellanca Packard diesel 225 hp.	France 23:22:49 Breguet 19 Hispano-Suiza, 600 hp.	09:11:53 Douglas DT-2 Liberty, 400 hp.	France 18:01:00 Breguet Hispano-Suiza, 600 hp.	02:13:49 Martin Bomber 2 Liberty, 400 hp.
Distance Closed Circuit (mi.)	France 5,564 Bernard Hispano-Suiza 650 hp.	2,516.6 Army T-2 Liberty, 375 hp.	France 2,710.4 Breguet 19 Hispano-Suiza, 600 hp.	590.3 Douglas DT-2 Liberty, 400 hp.	France 2,056.7 Breguet Hispano-Suiza, 600 hp.	
Altitude (ft.)	United States 43,166 Wright-Apache P. & W., 425 hp.	43,166 Wright-Apache P. & W., 425 hp.	France 30,654 Breguet 19 Farman, 500 hp.	28,143 TP-1 Liberty, 400 hp.	France 26,538 Breguet 19 Farman, 500 hp.	20,820 Bach Wright J-6
Speed in m.p.h. for: 100 km.	United States 249.3 Curtiss R-3-C-1 Curtiss V-1400	249.3 Curtiss R-3-C-1 Curtiss V-1400	United States 185.4 Lockheed Vega P. & W., 425 hp.	185.4 Lockheed Vega P. & W., 425 hp.	United States 176.0 Lockheed Vega P. & W., 425 hp.	176 Lockheed Vega P. & W., 425 hp.
500 km.	France 190.6 Nieuport-Delage Hispano-Suiza, 500 hp.	167.8 Verville-Sperry Wright, 350 hp.	Czechoslovakia 172.0 Letov S 516 Asso, 800 hp.	171.2 Lockheed Vega P. & W., 425 hp.	United States 168.3 Lockheed Vega P. & W., 425 hp.	168.3 Lockheed Vega P. & W., 425 hp.
1,000 km.	France 178.0 Dewoitine 26 Hispano-Suiza 500 hp.	127.4 DH-4L Liberty, 400 hp.	Czechoslovakia 171.0 Letov S516 Asso, 800 hp.		Czechoslovakia 157.0 Aero A-42 Asso, 800 hp.	152.7 Lockheed Vega P. & W., 425 hp.
2,000 km.	France 142.0 Latecoere 28 Hispano-Suiza 650 hp.	114.2 DH-4L Liberty, 375 hp.	France 142.0 Latecoere 28 Hispano-Suiza 650 hp.		France 142.0 Latecoere 28 Hispano-Suiza 650 hp.	
5,000 km.	Spain 129.0 Breguet Hispano-Suiza, 600 hp.					

Class C2 (Seaplanes)

Kg. payload	0		500		1,000	
	World	American	World	American	World	American
Duration (hr., min., sec.)	United States 36:01:00 PN-12 2 Wright, 525 hp.	36:01:00 PN-12 2 Wright, 525 hp.	France 31:01:00 Latecoere 28 Hispano-Suiza, 600 hp.	20:45:40 PN-10 2 Packard, 600 hp.	France 20:02:00 Latecoere 28 Hispano-Suiza, 600 hp.	17:55:14 PN-12 2 Wright, 525 hp.
Distance Closed Circuit (mi.)	France 2,677 Latecoere 28 Hispano-Suiza 600 hp.	1,569 PN-10 2 Packard, 600 hp.	France 2,611 Latecoere 28 Hispano-Suiza, 600 hp.	1,569 PN-10 2 Packard, 600 hp.	France 1,773 Latecoere 28 Hispano-Suiza, 600 hp.	1,336 PN-12 2 P. & W., 525 hp.
Altitude (ft.)	United States 38,560 Wright-Apache P. & W. 425 hp. S.	38,560 Wright-Apache P. & W. 425 hp. S.	United States 26,922 Sikorsky S-38 2 P. & W. 575 hp.	26,922 Sikorsky S-38 2 P. & W., 575 hp.	United States 26,929 Sikorsky S-38 2 P. & W. 575 hp.	26,929 Sikorsky S-38 2 P. & W. H., 575 hp.
Speed in m.p.h. for: 100 km.	Great Britain 331.7 Supermarine S-6 Rolls Royce R	241.7 Curtiss R-3-C-2 Curtiss V-1550	Germany 161.5 Heinkel HD3 B. M. W., 600 hp.	147.2 Vought Corsair P. & W., 425 hp.	Germany 146.2 Heinkel B. M. W., 600 hp.	92.53 PN-10 2 Packard, 600 hp.
500 km.	United States 161.14 Curtiss Navy C-3 Curtiss D-12, 450 hp.	161.14 Curtiss Navy C-3 Curtiss D-12, 450 hp.	Germany 146.6 Heinkel HE 9a B. M. W., 600 hp.	136.02 Vought Corsair P. & W., 425 hp.	Germany 146.6 Heinkel HE-9a B. M. W., 600	90.52 PN-10 2 Packard, 600 hp.
1,000 km.	Germany 138.1 Heinkel HE9 B. M. W. VI, 600 hp.	130.9 Vought Corsair P. & W., 425 hp.	Germany 138.1 Heinkel HE9 B. M. W.6, 600 hp.	88.69 PN-10 2 Packard, 600 hp.	France 118.1 Latecoere 28 Hispano-Suiza, 600 hp.	88.69 PN-10 2 Packard, 600 hp.
2,000 km.	France 117.4 Latecoere 28 Hispano-Suiza, 600 hp.	78.64 Navy PN-10 2 Packard, 600 hp.	France 117.4 Latecoere 28 Hispano-Suiza, 600 hp.	78.7 PN-10 2 Packard, 600 hp.	France 117.4 Latecoere 28 Hispano-Suiza, 600 hp.	81.04 PN-12 P. & W., 525 hp.

World and American records

In these tables and those on the following page, records for duration, distance, and speed have been credited as made without waiting for homologation by the F.A.I. Altitude records, which are often changed by calibration, are not so included. The last two record tabulations published by AVIATION appeared in the issues of Aug. 24, 1929, and March 22, 1930.

2,000		5,000
World	American	World
France 16:59:00 Farman 302 Hispano-Suiza 650 hp.	01:47:10.5 Barling Bomber 6 Liberty, 400 hp.	Germany 03:02:00 Junkers G-38 4 Junkers
France 1,615 Farman 302 Hispano-Suiza 650 hp.		Germany 311.7 Junkers G-38 4 Junkers
France 24,623 Farman 160 2 Farman 500 hp.	6,722 Barling Bomber 6 Liberty, 400 hp.	France 11,765 Super Farman Goliath 4 Farman, 500 hp.
United States 164.4 Ford 3 P. & W. Wasps, 420 hp.	164.4 Ford 3 P. & W., 420 hp.	Germany 114.6 Junkers G-38 4 Junkers
France 140.0 Latecoere 28-2 Hispano-Suiza 650 hp.		Germany 107.5 Junkers G-38 4 Junkers
France 139.6 Latecoere 28-2 Hispano-Suiza 650 hp.		
France 91.5 Farman 302 Hispano-Suiza 650 hp.		

2,000		4,000
World	American	World
United States 16:39:00 PN-12 2 P. & W., 525 hp.	16:39:00 PN-12 2 P. & W., 525 hp.	Germany 6:01:56 Dornier Superwal 4Gnome-Rhone-Jupiter
United States 1,336 PN-12 2 P. & W., 525 hp.	1,336 PN-12 2 P. & W., 525 hp.	Germany 621.4 Dornier Superwal 4Gnome-Rhone-Jupiter
United States 19,928 Sikorsky S-38 2 P. & W., 575 hp.	19,928 Sikorsky S-38 2 P. & W., 575 hp.	Germany 9,334 Dornier Superwal 4Gnome-Rhone-Jupiter
France 136.6 Latecoere 28 Hispano-Suiza, 650 hp.	90.5 PN-10 2 Packard, 600 hp.	Germany 130.1 Dornier Superwal 4Gnome-Rhone-Jupiter
France 125.6 Latecoere 28 Hispano-Suiza, 650 hp.	90.52 PN-10 2 Packard, 600 hp.	Germany 111.4 Dornier Superwal 4Gnome-Rhone-Jupiter
Germany 110.2 Dornier Superwal 4Gnome-Rhone-Jupiter	88.7 PN-10 2 Packard, 600 hp.	Germany 110.2 Dornier Superwal 4Gnome-Rhone-Jupiter
United States 81.04 PN-12 2 P. & W., 525 hp.	81.04 PN-12 2 P. & W., 525 hp.	

Important miscellaneous records

	World	American
Airline Distance (mi.) (Landplane)	United States 4,999.0 Bellanca Wright, 300 hp.	4,999.0 Bellanca Wright, 300 hp.
Straightaway Speed (m.p.h.) (Landplane)	France 278.48 Ferbois Hispano-Suiza, 550 hp.	266.6 Curtiss R-2-C-1 Curtiss D-12a
Payload to 2,000 m. (lb.) (Landplane)	Italy 22,046 Caproni Ca 90 6 Isotta Fraschini	4,409 Barling Bomber 6 Liberty, 400 hp.
Refueling Duration (hr., min., sec.) (Landplane)	United States 553:41:00 Stinson Detroiter Wright, 300 hp.	553:41:00 Stinson-Detroiter Wright, 300 hp.
Refueling Distance (mi.) (Landplane)	United States 3,293 DH-4-B Liberty, 400 hp.	3,293 DH-2B Liberty, 400 hp
Airline Distance (mi.) (Seaplane)	France 1,972 Latecoere 28 Hispano-Suiza, 600 hp.	1,841 PN-9 2 Packard, 500 hp.
Straightaway Speed (m.p.h.) (Seaplane)	Great Britai 357.7 Supermarine S-6 Rolls Royce R	245.7 Curtiss R-3-C-2 Curtiss V-1400
Payload to 2,000 m. (lb.) (Seaplane)	Germany 14,220 Rohrbach Romar 3 B. M. W., 500 hp.	7,726 PN-10 2 Packard, 600 hp.
Altitude with payload of 5,000 kg. (Seaplane)	Germany 6,562 Rohrbach Romar 2 B. M. W., 500 hp.	

All records by countries

	Landplane	Seaplane	Total
United States	11	9	20
France	37	21	58
Germany	6	19	25
Italy	1	1	2
Great Britain	1	2	3
Spain	1	0	1
Czechoslovakia	3	0	3

Light landplane records

	First Category Two Seaters Weight empty less than 400 kg. (881 lb.)		Second Category Two Seaters Weight empty less than 280 kg. (617 lb.)		Third Category Single Seaters Weight empty ess than 350 kg. (440-771 lb.)		Fourth Category Single Seaters Weight empty less than 200 kg. (440 lb.)	
	World	American	World	American	World	American	World	American
Distance Closed Circuit (mi.)	France 2,152 Farman 231 Renault 95 hp.		France 621 Farman 230 Salmson 40 hp.		France 1,687 Albert Salmson, 40 hp.		France 782 Peyret—Mauboussin 10 A. B. C. Scorpion 34 hp.	
Airline Distance (mi.)	France 1,808 Farman 231 Renault 95 hp.		France 395 Farman 230 Salmson 40 hp.		France 1,794 Klemm	1,650 Barling NB3 Genet 80 hp.	France 529 Peyret—Mauboussin 10 A. B. C. Scorpion, 34 hp.	
Duration	France 29:38:00 Farman 231 Renault 95 hp.		France 7:34:00 Farman 230 Salmson 40 hp.		France 37:55:00 Klemm Salmson, 40 hp.		France 12:03:00 Peyret—Mauboussin 10 A. B. C. Scorpion, 34 hp.	
Altitude (ft.)	Germany 24,672 Darmstadt D-18 Genet Major, 100 hp.	18,543 Inland Sport Warner 110 hp.	France 17,400 Farman 230 Salmson 40 hp.	13,924 Curtiss-Wright Junior Szekely 45 hp	Germany 26,712 Darmstadt D-18 Genet Major, 100 hp.	24,074 Barling NB-3 Lambert 90 hp.	France 17,037 Peyret—Mauboussin 10 A. B. C. Scorpion, 34 hp.	10,525 Aeronca Aeronca 30 hp.
Speed for 100 km. (m.p.h.)	France 139.0 Farman 231 Renault 95 hp		France 104.0 Farman 230 Salmson 40 hp.		Great Britain 186.47 D. H. Tiger Moth DH 32, 130 hp.		United States 100.8 Prest Szekeley, 40 hp.	

Light seaplane records

	First Category Two Seaters Weight empty less than 500 kg. (881 lb.)		Second Category Two Seaters Weight empty less than 350 kg. (771 lb.)		Third Category Single Seaters Weight empty less than 437.5 kg. (963 lb.)		Fourth Category Single Seaters Weight empty less than 250 kg. (551 lb.)	
	World	American	World	American	World	American	World	American
Distance Closed Circuit (mi.)	France 927 Farman Renault 95 hp.		France 714 Farman 230 Salmson 40 hp.		Germany 1,331 Junkers J 50-W Genet, 85 hp.		France 102 Peyret-Mauboussin A B C Scorpion 34 hp.	
Duration	France 11:06:00 Farman Renault 95 hp.		France 11:31:00 Farman 230 Salmson 40 hp.		Germany 16:29:00 Junkers J 50-W Genet, 85 hp.			
Altitude (ft.)	Italy 17,462 Caproni Cirrus Hermes 105 hp.		France 10,598 Farman 230 Renault 40 hp.		Germany 18,539 Junkers J 50 W Genet 85 hp.		France 11,352 Peyret-Mauboussin A B C Scorpion 34 hp.	
Speed for 100 km. (m.p.h.)	France 118.0 Farman 231 Renault 95 hp.		France 87.0 Farman 230 Renault 40 hp.		Germany 102.8 Junkers J 50-W Genet, 85 hp.		France 76.0 Peyret-Mauboussin A B C Scorpion 34 hp.	

Keeping planes safely in the air with a minimum outlay for repair and maintenance is one of the most pressing problems confronting the airline operator today. Mr. Harris' discussion of the methods used in accounting for maintenance costs on the Ludington Lines should be of interest to everyone concerned with the economics of air transport work. We hope that it will lead to wide discussion of this important subject.

Keeping track of the maintenance dollar

By Luther Harris

Superintendent of Maintenance,
The Ludington Lines

THE selling price of commodities or services is more often than not determined by adding a reasonable profit to the total cost of manufacture and distribution. The selling price of a seat in a transport airplane between almost any two points in the United States at least, bears no relationship whatever to the cost per passenger-seat of flying the airplane between the two points, but is determined almost entirely by the tariff charged for the same transportation by competing carriers on the ground. Time was when a sizeable increment could be added over and above these rates which many people were willing to pay for the novelty of traveling by air, but nowadays when air transportation has become an accepted mode of travel, this factor must be fully discounted. It is becoming more and more apparent that an airline can survive economically only as long as it offers to the traveler frequent, dependable, and comfortable service at rates which do not exceed that which he would have to pay for first class accommodations between the same two points by rail. With the revenue thus fixed by outside considerations, the problem of successful management becomes one of maintaining operation costs below the level of total income.

Assuming that a route has been chosen which has real traffic possibilities and that the management has made intelligent use of its opportunities to keep the general sales and operating overhead items at a minimum, the importance of keeping maintenance costs at the lowest possible level becomes apparent. The responsibility of the maintenance department is twofold as it must not only keep the airplanes in absolutely safe flying condition at all times and instantly available to meet the needs of the traffic department, but it must do these things with the least possible expenditure of funds. When it is considered that maintenance costs may account for two-thirds the total cost of the airline operation their importance becomes evident. In certain other fields, of which bus transportation offers probably the best example, the difference between profit and loss for the entire system depends almost entirely on the amount of money saved by the maintenance department in any given period, and it is not impossible that a parallel situation will occur in aircraft operations if it does not already exist. With this condition in mind, it is obvious that it behooves those responsible for upkeep and repair of airline equipment to keep the closest possible watch over their costs and to employ every possible means, consistent with maximum safety for planes in the air, to keep their expenditure to the lowest possible figure.

Maintenance accounting

In order to make an intelligent attack on the problem of lowering maintenance costs, it is obviously essential that some record-keeping system be set up which will show where the money is going, and which will reflect any saving or losses which may occur due to changes in the methods. Probably one of the greatest drawbacks to economical airline operations today is the fact that reliable figures as to detailed operation costs are not available to executives. In many cases the accounting system yields only an indication of the total coming in and going out, and the net profit or loss. This condition may exist even when bales of records are kept, and an office full of accountants has been hired to go over them; for the average accountant today rarely has sufficient practical knowledge of airline requirements to

permit him to make intelligent cost distribution.

Creating a system

Many lines develop from relatively small beginnings where an accounting system of almost the cash register type easily fulfills their requirements. As the business develops, however, such a simple system quickly breaks down. Planes must be serviced, parts must be stocked and an increasing payroll provided for. This finally gets beyond the capacity of the operator to handle personally and he calls in an accountant and dumps the whole problem into his lap. The latter proceeds to set up an elaborate system of accounts, has multitudinous forms printed and distributed and the process of draping the growing organization with red tape begins. An example of what may occur under such conditions happened in the case of one of the larger airlines. In setting up their accounting system under the supervision of a man who had no practical training in air transportation, it was thought logical to base their methods of distribution on those of an existing transportation company in another field. Accordingly, they went to one of the larger railroads and obtained from them a complete system of cost distribution. It soon developed that the problems were totally different and that methods of cost distribution which were sensible for railroad operation were wholly illogical for airline use. They found among other things that they were carrying accounts for the maintenance of roundhouses, and the repair and upkeep of grade crossing signs.

Difficulties such as these arise from the old idea of trying to make the tail wag the dog. No one would advocate a total disregard of precedent, but unless the past situation which established the precedent is found to be exactly parallel to the current requirement, its teachings should be applied with caution. The problems confronting the air transport operator today are totally different from those in any other field and it would seem more logical to permit accounting methods to develop with the needs of a given organization, rather than to attempt to impose a complete system (which may have worked for some other organization), and attempt to mold the new organization to fit. The men who are actually responsible for the servicing and maintenance are usually in a much better position to decide what facts should be known in detail, rather than some certified public accountant who probably does not know an engine from a tail skid.

A working example

It would be difficult to find an airline operation where maintenance costs are more significant, and their keeping more important, than on the Ludington Line, now engaged in flying passengers between New York and Washington. The present schedules call for fifteen round trips per day between these two points, using ten-passenger Stinson airplanes, each powered with three Lycoming engines. Twelve machines of this type are in service. The magnitude of the servicing requirements may well be judged from the fact that during the month of June these machines spent over 1,400 hours in the air. In this period ten of the planes had over 100 hours, seven more than 120 hours, and two over 140 hours. Economical considerations require that the accounting system be flexible enough to cover the activities of the several servicing crews and the usage of large quantities of gasoline, oil, and other materials without being complicated enough to require the presence of an extensive non-productive clerical staff. For this reason a simplified system of essential accounts has been established and the foremen of the various repair crews are responsible for making the proper distribution to the various accounts almost as soon as the actual work is performed.

All overhaul work and the major part of airplane and engine servicing is conducted in the Washington shop of the line. A small crew of men in charge of a servicing foreman is maintained at Newark, but their major function is to replenish gasoline and oil and make any necessary minor adjustments to enable the plane to complete the round trip to Washington. Both groups are under the direct supervision of the superintendent of maintenance, whose headquarters are at Washington. In addition to being responsible for the upkeep of the flying equipment, the latter also has direct charge of the specification and purchase of all supplies and materials used by that department. This connection with the latter function is highly important and will be discussed in more detail later.

Line and overhaul crews

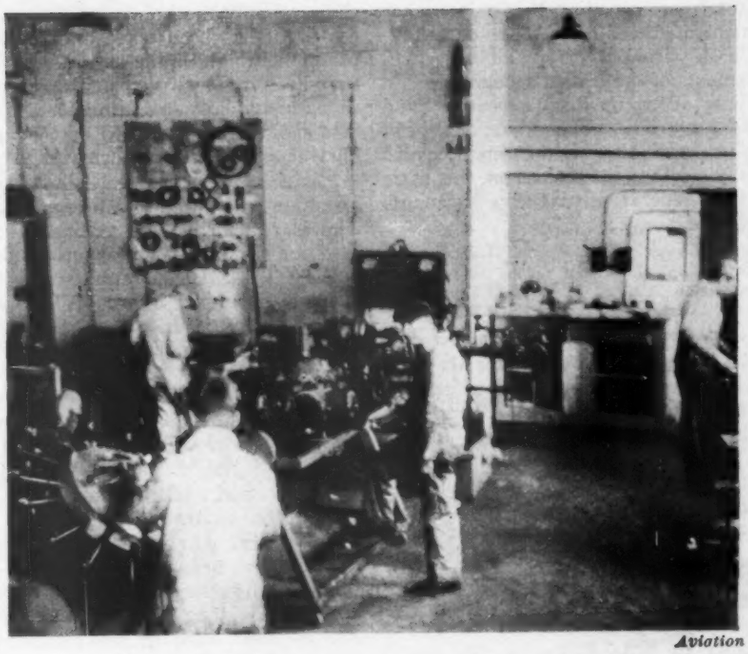
The maintenance department falls naturally into two divisions—the "line" and the "overhaul" crews. The line crews look after the airplanes and engines between flights, cleaning, refueling, checking oil, and making minor adjustments of defects noted from the pilot's report. The other crews take care of the periodic airplane and engine overhauling. All operations of this type are conducted at Washington, where separate crews under individual foremen are maintained for planes and engines. Every day one plane is removed

Aviation

The line crew at Washington servicing a Stinson monoplane for the New York run

from service and put in the hands of the airplane overhaul crew. Complete inspection of all parts is made and replacements or major adjustments are made as required. Every engine goes to the engine overhaul crew after each 300 hours of operation. It is completely disassembled and entirely rebuilt before being returned to service. During the 300 hours of operation, there are no top overhauls, but a daily inspection and a regular 40-hour checkup is conducted by the line crews. At these times all spark plugs are changed, oil is drained, valve clearances checked, and any other necessary adjustments made.

At the present time the line crew at Washington consists of a foreman and ten men and that at Newark of a foreman and five men. The engine overhaul unit at Washington has five mechanics besides the foreman, and the airplane overhaul eight men and a foreman. All foremen report directly to the superintendent of maintenance. In both the line and overhaul crews the work is subdivided so that certain men are responsible for certain specific items of overhaul. When inspection and maintenance work is placed on a volume production basis, a break-down in the organization spirit which may be reflected in the workmanship of the individual must be avoided. This has been overcome by placing the various parts and accessories in "groups." In this way it is possible to break down the responsibilities to such an extent that instead of one individual carrying the whole load, several good men feel equally important, and it is possible to utilize safely the services of more helpers with limited experience, as several men feel responsible for what is done by the inexperienced.



Aviation

Overhauling Lycoming engines in the Ludington shop at Washington

Simplification the keynote

In organizing the personnel, and in setting up the accounting system, every reasonable effort has been made toward the elimination of non-productive labor and toward the greatest simplicity of accounts. The Ludington Line is particularly well situated in this respect for, due to the fact that its mileage is relatively short, and the service frequent, a high degree of concentration is possible and the work can be closely supervised. All airplanes on the line pass through the Washington repair base at least twice every day and it is thus possible to keep very close track of all work which must be done on them, and it is very seldom that any work other than routine servicing must be done elsewhere. The aim of the accounting system of the maintenance department is to furnish the superintendent and the executive officers of the line monthly figures indicating exactly the cost per mile flown of all items entering into the upkeep of the equipment. The records of engine and plane miles flown are readily available from the pilot's report, and as all purchasing of supplies and material is done by the superintendent of maintenance, and as all supplies are kept in stock at the Washington shop, it is a relatively easy matter to compile the necessary monthly figures. A clerical assistant in the superintendenent's office receives all the necessary information from the pilots and from the several shop foremen to keep the figures posted daily. He also handles all the purchase orders and stock room requisitions.

All the expenditures of the maintenance department are allocated under one of four heads (1) labor, (2) material, (3) depreciation, (4) general overhead. A number of subdivisions are made under each of these items, but efforts have been made to keep the number of distributive accounts at a minimum. A great deal of time and energy can be absorbed in attempting to go into too much detail in the distribution of costs. If a system is permitted to get too complicated, clerical help must be provided in the shop to take care of the details, and, in the end, the result is a complication of small items which confuse rather than clarify. In this case only six subdivisions of the labor item are used, and it is a simple matter for a crew foreman to indicate on the daily time cards of his men the proper allocation of the charges. The line crew's time is distributed three ways: first, regular servicing on airplanes and engines, consisting of the routine fueling and oiling operations, inspection, checking, etc., between flights; second, routine engine inspection and service, which consists of the regular 40-hour check mentioned above; and third, the routine cleaning of each airplane inside and out between flights. All engine overhaul time is charged to one account which covers engine removal, overhaul and reinstallation. In the same way, the airplane overhaul time is charged to a single account which covers all major repairs to airplanes. The only other labor account covers clerical, engineering, and purchasing which consists essentially of the salaries of the maintenance superintendent and his clerical assistant.

The materials accounting is equally simple as all the items entering into the maintenance of the airplane and engine may be classified as (1) gasoline, (2) oil, (3) engine parts, (4) airplane parts. A few exceptions are made under the last heading and detailed costs are kept on certain individual parts as propellers, tires, instruments, spark plugs and batteries.

The depreciation of airplanes, engines and accessories is written off monthly on the basis of the number of hours flown in accordance with a predetermined schedule which has been set up by the management of the line. Certain items which are separate from the main airplane structures, such as radio equipment, instruments, etc., are depreciated separately. The overhead items, as in the case of any plant or shop, consist of the building and rental charges, and the light, power, water, etc., which are used.

Ten months' expenditures

During the first ten months of operation a total flying time of approximately 11,500 airplane hours, and 34,500 engine hours has been completed. An analysis of the expenditures of the line

has indicated that about 61 per cent of the total was spent by the maintenance department, the other 39 per cent having been disposed of by all other requirements of the traffic, accounting, and publicity departments, executive and pilots' salaries, communications, etc. Further analysis of the maintenance costs yields the following on the basis of the general distributive accounts mentioned above:

Labor	27.9 per cent
Materials	37.7 per cent
Depreciation	29.5 per cent
General overhead	4.9 per cent
Total maintenance costs	100.0 per cent

The importance of the materials item, which represents almost 38 per cent of the maintenance cost, and 23 per cent of the entire cost of operation of the line, cannot be overlooked, and is an indication of the need for careful purchasing, and the greatest possible cooperation with manufacturers of parts and supplies. The opportunities for savings in this item are very great, and results are immediately reflected in the company's balance sheet. It is of interest also to note the relatively small proportion of the cost devoted to the overhead in this particular case.

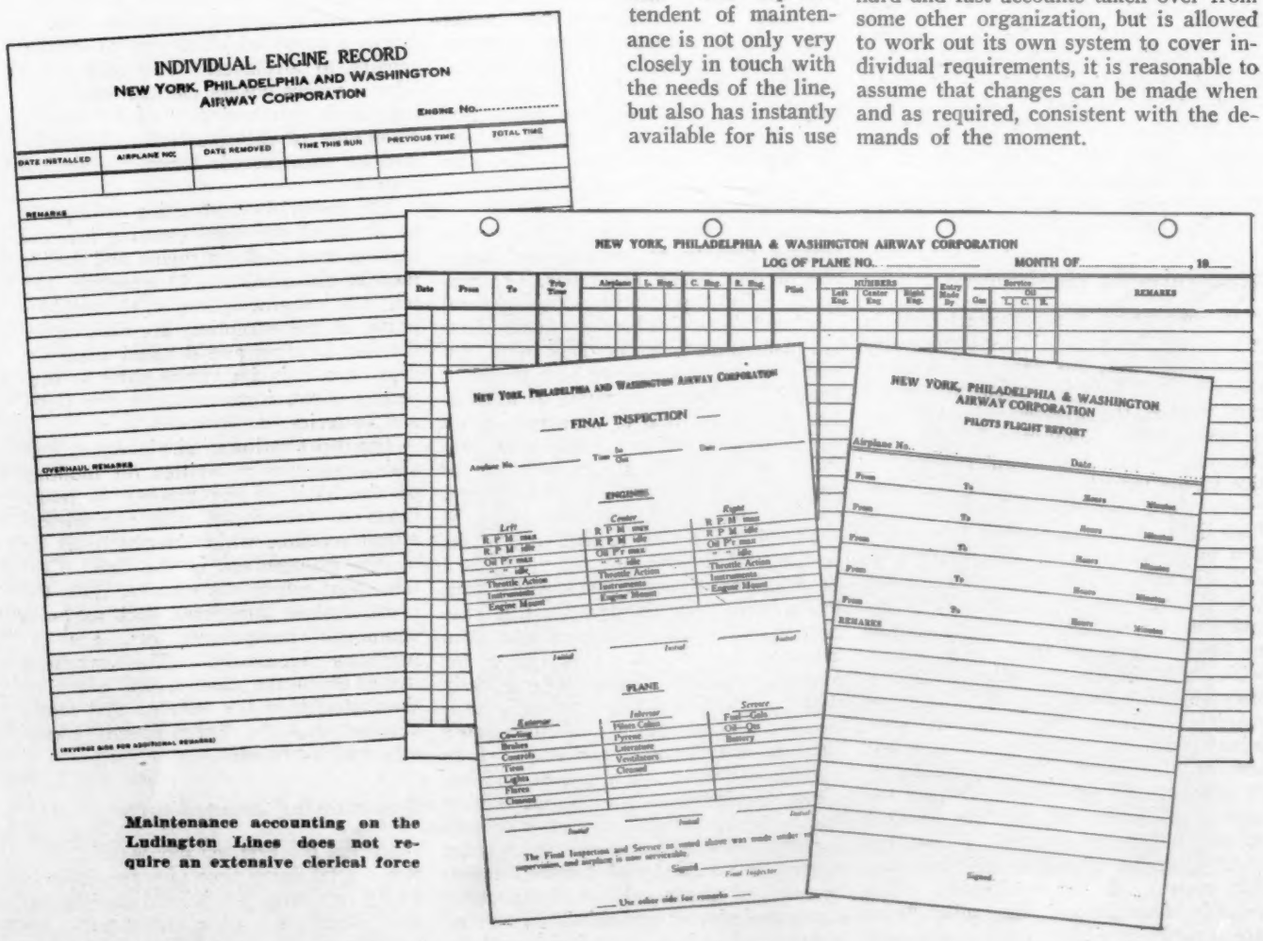
The forms required for the operation of this system are few and relatively simple. The pilot's report is the source of all airplane and engine hours and shows simply the points between which the flight has been made and the number of hours and minutes in the air. A log sheet for each airplane and engine showing its daily operation for a period of a month is kept up to date by posting the pilot's reports every day.

As indicated above the labor records originate with the foreman of each crew who is responsible for getting all time cards of his men to the superintendent's office daily. All materials used from stock are handled by requisition made out by the foreman, copies of which go to the superintendent's office. These are posted against card records of material on hand which combined with the purchase and receiving records kept in the same office afford a perpetual inventory of the major items in stock. Gasoline and oil withdrawals are handled on separate forms, but in the same general way. The general overhead items are compiled from the monthly bills received. In this manner, one man assisting the superintendent is able to keep track of the maintenance cost on the entire operation.

An aid to purchasing

The advantage from the combination of the maintenance and purchasing functions has been very real: The superintendent of maintenance is not only very closely in touch with the needs of the line, but also has instantly available for his use the exact cost of all items of expense in terms of airplane or engine miles flown. He is, therefore, in a very advantageous position to obtain materials and equipment from the various sources of supply on a basis of exact knowledge, rather than one of guess or estimation. A separate record is kept of the cost, life, and performance of all major items of equipment which are purchased which affords an excellent basis for future buying. He knows, for example, exactly how much it costs per landing for tires, and can thus compare the cost of any new tires with the performance of the old and has a logical basis of comparison by which to measure improvements. In this way, in the first eight months of operation, it was possible to reduce the actual cost of tires per landing, on one of the standard tri-engined Stinsons from about .16 cents to approximately .09 cents per landing. There is little doubt but that if the purchasing department was separated from the maintenance department and operated from some remote central office, the advantages arising from such close cooperation would be lost in many cases.

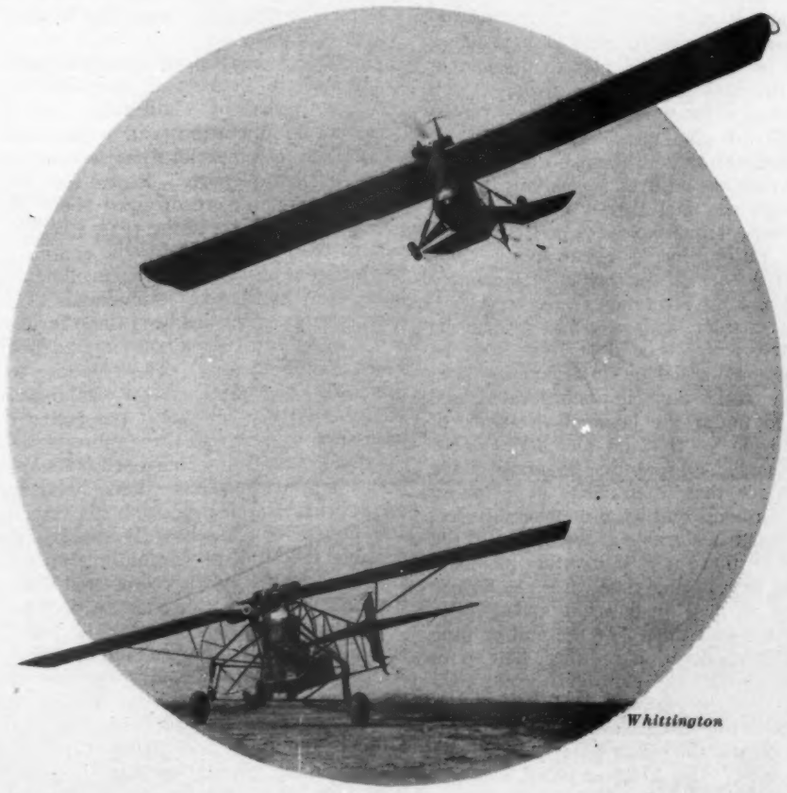
As time goes on, and the number of airplanes on the line increases, the problem of maintenance accounting will undoubtedly become more complicated, but inasmuch as the organization is unhampered by a predetermined system of hard and fast accounts taken over from some other organization, but is allowed to work out its own system to cover individual requirements, it is reasonable to assume that changes can be made when and as required, consistent with the demands of the moment.


INDIVIDUAL ENGINE RECORD
NEW YORK, PHILADELPHIA AND WASHINGTON AIRWAY CORPORATION
NEW YORK, PHILADELPHIA & WASHINGTON AIRWAY CORPORATION
LOG OF PLANE NO.
MONTH OF
FINAL INSPECTION
PILOTS FLIGHT REPORT

Maintenance accounting on the Ludington Lines does not require an extensive clerical force

As a result of the development of the light plane market, there has been a rather complete change in the aspects of private flying instruction. Through the use of inexpensive and economical equipment it is possible to reduce the cost per hour of dual and solo time to unexpected levels. The several phases of this movement as it exists on the Pacific Coast are described in this article which is the result of a survey of the methods of a number of operators.

Low cost flying time for private instruction



The student on the ground performs a turn in the same manner as the pilot in the air

A RECENT survey of Pacific Coast flying schools indicates a growing trend toward popularization of private flight training, largely through very greatly reduced costs of instruction in certain quarters. The flying schools have been forced into such a program by the decreasing interest in commercial training which has lately manifested itself. There has been a gradual slackening of pressure on commercial courses as the present surplus of commercial pilots became a matter of common knowledge. The increasingly rigid requirements for commercial pilots have gradually directed the bulk of commercial training to the large and well-equipped schools which were best qualified to instruct advanced students. Thus the average small school has been forced to seek students from among those who look upon flying from the amateur viewpoint. It is the non-professional group with which we will concern ourselves primarily in this article. Catering to amateur pilot-students has forced radical changes in the methods of conducting schools. Commercial students fitting themselves for a profession will pay reasonably high rates for their schooling. But to induce large numbers of amateurs to undertake flight training it is necessary to offer them a price which they can justify from the standpoint of recreation. The standard rate of approximately $500 for a complete private course is much too high to reach a satisfactory volume of students. Courses have been offered in southern California during the present season with rates of from $30 to $80 for training to solo and from $80 to $130 for training to private pilot's license. Rates range from $4 per hour up for sole time and from $6 per hour up for dual time with a competent licensed instructor. Naturally, such rates are being given in connection with training on a basis somewhat different from that which has been in effect in the larger training schools. In some cases pilot instructors are working for a monthly wage as low as $150. In other cases the instructor, operating independently, has cut his overhead to the irreducible minimum by lving in the hangar with his plane and practising the most rigid personal economies. Such sacrifices, however, are bringing flying instruction to many people who until recently would not have seriously considered the matter, and individual pilot-instructors are operating in towns which could never have supported a large, organized school. Training has been so extended to small population centers that some instructors are building up small-town circuits, flying from town to town within a reasonable range of the home base and conducting all business

and training on a direct personal contact basis.

Analyzing the new trend

There are three major phases of the new private training trend. These include non-profit clubs; individuals or schools specializing in low-rate private training with standard equipment; and special applications of the new light planes which are being introduced.

Possibilities of the non-profit club plan, which has been successfully placed in operation in various forms at several points on the Pacific Coast, are well illustrated by the experience of the K-15 Flying Club, Ltd., of Los Angeles. This club has been in operation approximately one year, has piled up almost 1,000 plane-hours, and has trained sixteen men to private pilot's license and beyond. The K-15 club was originally formed with fifteen members, most of them employees of the Kinner Airplane and Motor Corporation, now has 23 members in spite of the fact that seven of the original fifteen have dropped out, and has a campaign under way to increase the club membership to 50 and to purchase an additional training plane. This club has enjoyed special advantages through the fact that a number of its members were employees of the Kinner Corporation, but a great many clubs could be formed throughout the country with similar advantages as a result of some contact with a plane or engine factory, a sales or operating firm, or other commercial organization.

The K-15 club is incorporated and limited under the laws of the state of California so that its members cannot be assessed and cannot be made liable for more than their $100 membership fee. In addition to the membership fee, which is transferable at the option of the member, there is a $5 monthly membership dues. Flying time rates are $6 per hour for dual instruction and $4 per hour for solo time. At the end of nine months of operation and after 800 hours of flying time the club had developed a large enough reserve fund to make it possible to purchase a new plane at once even if the old one were completely wrecked. The club employs a pilot-mechanic instructor full time, guaranteeing him $150 per month or $2.50 per hour of flying time. The plane is kept in a modern hangar on United Airport, Burbank, and the club carries public liability and property damage insurance to a maximum of $30,000. No accident insurance is carried on the plane, the cost being considered prohibitive, but the club lays aside $500 per year as a crack-up fund and to cover depreciation. On the basis of 800 of flying it has cost 1.7 cents per mile for fuel and oil, 2.4 cents per mile for fuel, oil and all repairs, and 6.66 cents per mile for all costs including hangar rent, pilot's salary, insurance, and general club expenses.

Another plan which has been gaining much ground is that whereby a qualified licensed transport pilot buys a standard type training plane, usually (a used piece of equipment) at a reduced price, and goes into business for himself at rates so low as to make the enterprise economically hazardous and a personal hardship in any case. Rates commonly in vogue under these circumstances are $12-$15 per hour for dual instruction and $8-$10 per hour for solo time. Such rates are only possible where the pilot acts as his own mechanic, operates without insurance, and practises a high degree of economy in every direction. Although large schools will regard these rates as suicidal it seems well established that careful, energetic pilot instructors can operate on this basis profitably, barring accidents. Such a plan as this has the advantage of giving the student a more direct, personal service, and of extending training facilities to a lower strata of students than those which it is possible for the larger, centrally located school to reach.

The trend of approved schools toward low priced training is well illustrated by the operations of California Aerial Transport, operating an approved private and commercial flying school on Los Angeles airport. Rates for the regular courses were dropped about 30 per cent on the first of the year, a reduction to $330 from $475 for the complete private course, and student enrollments have been appreciably stimulated. Of even greater effect has been the offering of solo time at $10 per hour in standard Fleet training planes. The response to this offer, coming from an established school, was so great that it was recently necessary to purchase three more training planes. Solo time increased from 199 hours in January, to more than 240 hours in February and promised to exceed 300 hours for March. By making it possible for students to continue flying at low cost after having completed their training a considerable volume of general and recreational flying is being stimulated. This large volume of flying serves to take care of a large portion of the school overhead and has proved to be a good business proposition at the $10 per hour rate. Solo flying is further stimulated by giving one-half hour of time free with each five hours of solo time flown per month.

Importance of the light plane

The perfection and introduction of the light plane promises to become the strongest single factor in the private training field. The use of such machines in training reduces both unit cost and time to solo. Prices in vogue to date on light plane training range from $5 and up solo and from $10 and up dual.

There are several plans under which the new light planes are being employed. Some purchasers of single-place light planes, are making it a practise to rent their equipment to other pilots for solo flying, the rates often running even lower than $5 per hour. The private owner faces possible loss of his equipment under this plan but barring accident it is economically to his advantage and with the wider ownership of light planes it promises to be much more generally engaged in.

Another scheme which shows promise, but has barely been tried as yet, is for the individual operator to go into business with no other equipment than one or more light planes in which he can give instruction at very low rates.

The employment of light planes by established schools is meeting with considerable success. The D. C. Warren Company, San Francisco Bay Airdrome, has been operating a dual control American Eaglet since the first of the year. This firm established a price schedule, applying both to the Eaglet and the Curtiss Junior, by which dual time is offered at $10 per hour and solo time at $7.50 per hour if the student contracts for twenty or more hours. During the first month that this course was offered 28 students were signed up on a contract basis. After some 200 hours of student work this firm has concluded that it will soon be practicable to solo students after not more than five hours of dual instruction, reducing the cost of instruction prior to solo to but $50. Another operator of Eaglets, the Spicer-Santry Company of Los Angeles, is selling dual time at $10 per hour and solo at $5 per hour.

A low rate club plan for flight training with Aeronca planes has been put in operation on Alameda Airport by F. Myrten Johnston. Solo time in the Aeronca is sold for $7.50-$8 to transient customers. For the club members a plan has been offered giving them sufficient dual training and solo time for a private pilot license at a total cost of $115. Under the club plan members pay $15 cash to the school and borrow an additional $100 from the Bank of Italy on an arrangement which permits this amount to be paid back at the rate of $2 per week. Thus the school is paid the entire cost of the training at once and the student is free to go ahead with his instruction as rapidly as circumstances and his ability will permit.

An interesting training plane development is that of the Cycloplane Company of Los Angeles. This organization has developed a system of solo training reminiscent of the early pusher days and of the war time French Penaud clipped wing ground trainers, has obtained an approved type certificate and is starting instruction work. The instructor does not fly but directs the activities of one or more students in a like number of machines. By the use of a variable throttle stop, students pass through easy stages from taxiing to actual flying. This method is similar to the solo systems in use at several airports in other parts of the country.

Keystone

A brief glimpse at the 1931 Tour

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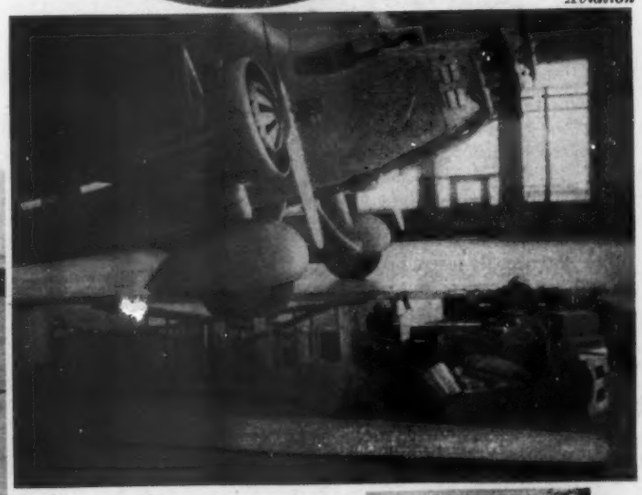
Aviation

Above: Ready to go at the Ford Airport. Circle: Giving the pilot of No. 17 the word that the timers are ready for him to land for his trial in the "stick" test. Right: The wise Tour pilot expects no assistance from the airports along the way, but makes himself self-sufficient. Furthermore, tools and supplies count for just as much as sandbags or passengers as contest load. So one of the competing Fords loaded in this pile of baggage and equipment, including corrugated duralumin for patches and step-ladders for reaching the engines.

Aviation



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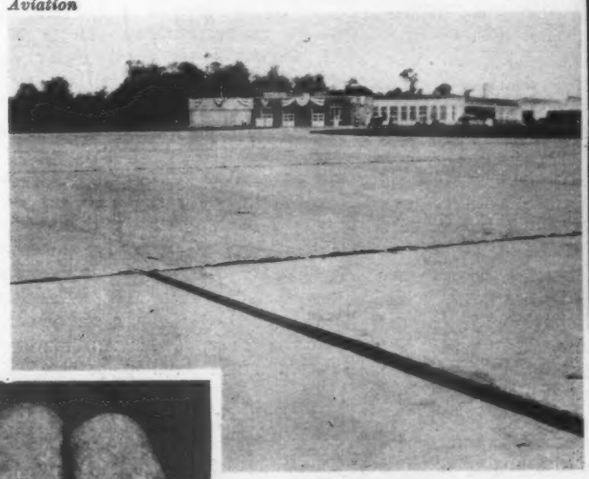


Aviation

Above and left: An incidental result of the "stick" tests, and a demonstration of brake efficiency. With a heavy plane's whole performance under the Tour formula depending on the time taken to pull up after landing, the pilot came in to land with the brakes already set up to the limit. He struck just short of a tar expansion joint in the runway, and the resultant smear gives proof that the wheels were locked and stayed so. But the tires (at left) told the same story on their own account, and a new pair had to be put on for each landing trial. On one of the light planes, which had no brakes, the pilot reduced the stick time six seconds by reaching out and pressing his hands against the tires.

Right: Walter E. Lees, chief timer of the Tour, who flew a diesel-engined Waco plane over the course.

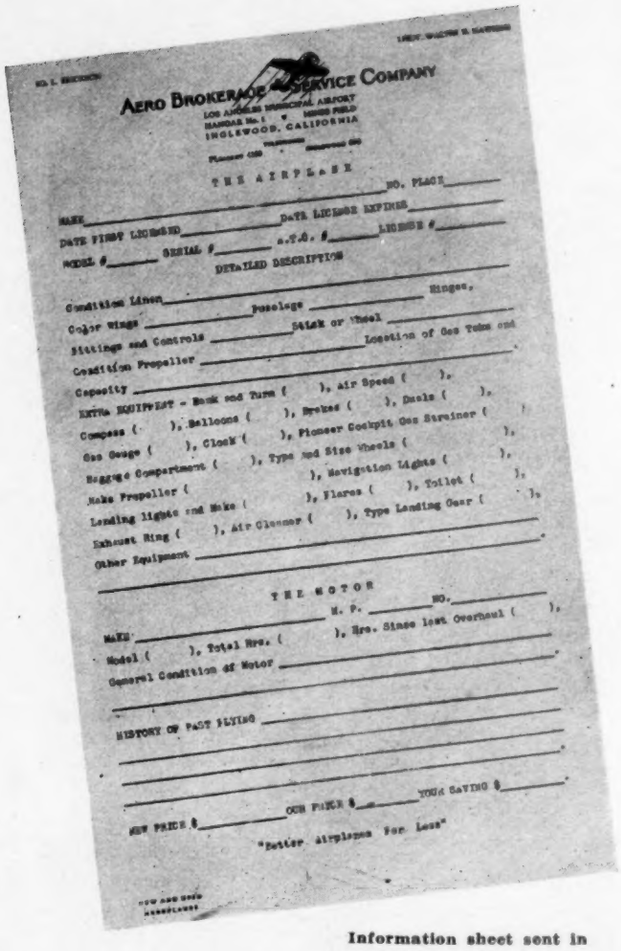
Aviation

Profits from airplane sales with merchandising expense at an absolute minimum

Reduced-rate aircraft merchandising

By Ed. L. Erickson and Lieut. Walter B. Hawkins

Aero Brokerage Service Company
Mines Field, Inglewood, Cal.



AERO BROKERAGE SERVICE COMPANY
LOS ANGELES MUNICIPAL AIRPORT
HANGAR No. 1 MINES FIELD
INGLEWOOD, CALIFORNIA

THE AIRPLANE

MAKE _____ NO. PLACE _____
DATE FIRST LICENSED _____ DATE LICENSE EXPIRES _____
MODEL # _____ SERIAL # _____ A.T.C. # _____ LICENSE # _____
DETAILED DESCRIPTION
Condition Linen _____ Fuselage _____ Hinges _____
Color Wings _____ Stick or Wheel _____
Fittings and Controls _____ Location of Gas Tank and
Condition Propeller _____
Capacity _____
Extra Equipment - Bank and Turn ( ), Air Speed ( ),
Compass ( ), Balloons ( ), Brakes ( ), Duals ( ),
Gas Gauge ( ), Clock ( ), Pioneer Cockpit Gas Strainer ( ),
Baggage Compartment ( ), Type and Size Wheels ( ),
Make Propeller ( ), Navigation Lights ( ),
Landing Lights and Make ( ), Flares ( ), Toilet ( ),
Exhaust Ring ( ), Air Cleaner ( ), Type Landing Gear ( ),
Other Equipment _____

THE MOTOR

MAKE _____ H. P. _____ NO. _____
Model ( ), Total Hrs. ( ), Hrs. Since last Overhaul ( ),
General Condition of Motor _____

HISTORY OF PAST FLYING _____

NEW PRICE $_____ OUR PRICE $_____ YOU'd SAVING $_____

"Better Airplanes for Less"

Information sheet sent in answer to specific requests

DURING 1930 about 75 per cent of our patrons were private flyers who bought planes for their own use, and the average price of the planes was less than $2,000. The majority of these people were substantial business men with ample means, but they bought bargains in airplanes because they felt that such expenditures were in the luxury class and should be kept as low as possible.

The private market is steadily expanding, and sales to private owners can be appreciably extended in the near future if satisfactory equipment can be offered at attractive prices. The used plane has supplied the major portion of this market to date, but we expect to see an increased volume of new sales on light planes. Of course the use and re-sale of these low-powered planes will broaden the used plane market still more, and create even greater opportunities for the merchandiser of used planes than those which now exist.

The used plane lends itself particularly well to our method of merchandising, which features a large and varied stock of equipment handled on a consignment basis, offering the customer a wide selection, both as to type and price, and making a fairly high volume of business possible.

Sixty planes and a miscellaneous lot of parts, accessories and equipment were sold last year by a total personnel of two men and one secretary, operating from a single hangar on Los Angeles Municipal Airport. Overhead costs are kept at an absolute minimum. Even our fairly high volume of sales and comparatively liberal commissions would not pay us a profit if we were forced to carry the overhead which has burdened so many who have attempted to sell new airplanes during the last two or three years. The major item of expense is hangar rent and the cost of maintaining a small hangar office. The two of us together handle practically all phases of the business, from sweeping the floor and wiping off the planes on display, to making calls on prospects or operating our own mimeograph machine for the publication of our semi-monthly sales bulletin. No sales tours, demonstrations, or deliveries are made, and we believe that it is only through such drastic curtailments of overhead expenses that aircraft selling can be made profitable at the present time.

Dealer sales tours are exceedingly expensive and can hardly produce sufficient immediate business to make them profitable. It is difficult to conduct a successful follow-up campaign after an extensive demonstration tour. The dealer's money might better be spent in providing an extensive stock of flying equipment at his home base and in encouraging prospects to visit him there. It is possible for dealers in used planes to build up a very large stock at low expense by operating on a consignment basis, buying for re-sale only where the prospective profit will fully justify the capital outlay. It is certainly desirable for the dealer in new planes to handle as many different types as he is capable of fairly representing. It may prove to be a good policy for the manufacturers to sell planes through well-established dealers on a consignment basis in order to maintain a sufficient stock on display.

Demonstrations

Demonstrating, as it is now commonly practised, is one of the most expensive phases of aircraft selling and is a real deterrent to sales in many cases. Many good prospects have been frightened out of taking up flying by a too-successful demonstration. If a prospect is a licensed pilot and is known to us we will permit a short flight in order that he may satisfy himself as to the flying qualities of the plane he considers buying. Non-pilot prospects who wish to hire their own pilot are permitted to take planes up for a short trial flight if the pilot is sat-

isfactory. In such a case, however, an effort is always made to talk with the pilot before the flight and impress upon him the desirability of making a smooth and stuntless flight. In general if a man is not sold on the ground he will not be in the air. If he is definitely sold on the ground there is no objection to a trial flight before final purchase. Wherever demonstrating is employed, all stunting and violent maneuvering should be eliminated.

An excellent example of the importance of proper demonstrating occurred locally several months ago. A wealthy prospect was known to be in the market for a flying course and possibly an airplane. The pilot-salesman of a rather large concern took this man up and gave him a "normal" demonstration flight which so frightened the prospect that he swore he would never get in a plane again. Some months later a private operator on Los Angeles Airport, succeeded in winning this man's confidence and in gaining his consent to one more trial flight. He gave the prospect a perfectly steady ride, as nearly devoid of all sudden maneuvers as he could make it, and brought him down with a new conception of what flying can be like. This man subsequently learned to fly under the operator's instruction, and then sent his wife and two daughters out for flying instructions, and often for cross-country pleasure trips. Every member of the family now carries a pilot's license and the average revenue to the operator from this source alone was almost $1,000 a month over a period of months. There are a great many such prospects now available and a safe and sane sales psychology is going to put them in the air and thereby increase the sale of private flying equipment.

We do not deliver planes, even on a promise to purchase, because we believe that bringing the prospect to the dealer's sales headquarters is a fundamental principle of selling in the present market. It costs money to deliver a plane and this cost must be subtracted from the profit. Of much greater importance, however, is the time lost by the salesman who delivers a plane in person. That same time might be spent in profitably interviewing several customers at the sales headquarters, if the proper means is taken to bring customers to the salesman. Also, if a plane were delivered under the promise to buy, the sale of that particular plane would complete the deal. If, however, the prospect is handled at sales headquarters it may be possible to sell him a more expensive plane, a parachute or other equipment or, in any case, he is sent away from the hangar so impressed with the completeness of the stock that he will probably return from time to time, and is almost sure to send other prospects.

Parrish — Ed. L. Erickson — *Putnam*

Lieut. Walter B. Hawkins

Simple sales literature

Sales bulletins consisting of a single sheet of mimeographed paper listing all outstanding bargains on hand and sent twice monthly to more than 1,500 prospects, state briefly the name of equipment, its general condition, and the price. From time to time the list is checked to make sure that our bulletins are being received and are appreciated, sending our literature only to those who wish it. When a prospect writes back asking for further particulars with regard to a certain plane or engine, a mimeographed form is filled in with the necessary data and returned to him, thus saving materially on the cost of letter writing. In sales bulletins or personal letters the exact condition of the plane under consideration is stated. It has been found that sales are encouraged by quoting the price in letters and at the same time giving an exact and uncolored description of the equipment under consideration. This policy helps to close sales when the prospect arrives in person to inspect the plane advertised and finds that it really is as represented. It has been found possible also to sell a considerable number of planes by mail, shipping them to various parts of the country, on a basis that they are guaranteed to be exactly as represented or money back. All equipment sold is licensed by the Department of Commerce or guaranteed to be in licensable condition.

As a supplement to the sales bulletins return cards are enclosed from time to time asking the recipients to fill in the types of equipment in which they are interested and the prices they have in mind paying. Thus it is possible to classify prospects and directly solicit the right ones when a particularly attractive buy is on hand.

Sales are all made on the basis of at least 65 per cent cash. If the prospect cannot raise this portion of the total price he will not be sure of meeting the monthly payments on the

"Even our fairly high volume of sales and comparatively liberal commissions would not pay us a profit if we were forced to carry the overhead which has burdened so many who have attempted to sell new airplanes during the last few years."

balance. In any case we cannot afford to waste time and money on repossessed merchandise. It is preferable to lose an occasional sale through adherence to a high down payment plan than to undertake to cope with extended credits and uncertain payments. The purchaser buying a plane for business purposes who cannot raise more than half the purchase price is attempting to operate on too narrow a margin of capital. The private flyer buying a plane for pleasure and sport who cannot raise more than half the down payment cannot afford to support an airplane anyway. Some customers who are well and favorably known by their local bankers make independent financial arrangements which enable them to meet these terms and still to pay for the equipment out of income. There can be no real objection to such an arrangement.

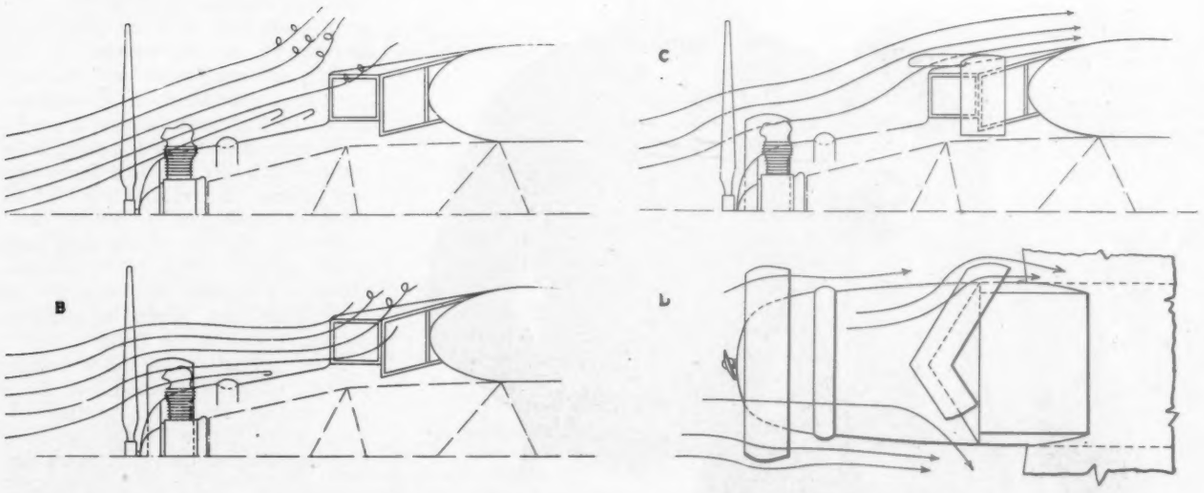
Since about 75 per cent of our customers buy low priced planes for their private use, the conclusion is that there is a rather large field open to the manufacturer and merchandiser of light equipment to sell at less than $2,000. Such equipment should be applicable to the use of small operators as well as private flyers. These small operators, conducting flying schools and general service operations on the basis of low overhead and the utmost personal service are meeting with considerable success in this locality and as their numbers increase they will provide a fairly active market for new equipment in the low price range.

A "custom-building" basis

However, the time for real quantity production and sale of aircraft has not yet arrived. Every customer wants something different. It has been possible for us to do a fairly large volume of business only because of the widely varied stock with its ability to meet almost any customer requirement. The manufacturer, limited as to the number of models he can efficiently produce, will probably find it wisest to build in limited quantities on a "custom-built" basis for some time to come. This applies in a material degree even to the low price class where customers often wish to specify the particular engine with which the plane is to be powered, the gasoline capacity, exterior finish, and interior appointments. The satisfaction of each individual customer on as many of these points as possible will make sales and is making sales for the used plane merchant. The new plane distributor, to gain the same advantage, must handle as many different models as possible, with various power plants as optional equipment, and with a variety of finishes for the customer's consideration.

Business for us has been good during a generally dull year, and has improved steadily as we have built up a clientele of satisfied, repeat customers. We believe that other aircraft merchandisers, of either used or new planes, can do at least as well if they will apply the same general policies which have proved so successful with us.

Extending the use of ring cowling



Airflow about the nose of a cabin monoplane. (A) conventional cowling, (B) Townend ring added, (C-D) possible application of auxiliary airfoil to reduce turbulence around cockpit enclosure

THE benefits derived from the use of cowling rings around radial engines are now well recognized, and have led to the consideration of similar devices on other airplane parts which are the cause of excessive drag by reason of irregular airflow around them. Mr. W. H. Evers, of the Curtiss-Wright Corporation, in his paper "Engine Ring Cowlings" read before the recent meeting of the Aeronautics Section of the American Society of Mechanical Engineers at Baltimore, pointed out that one of the worst conditions of airflow occurs around the cockpit enclosure of a cabin airplane, and indicated how an auxiliary airfoil could be installed to smooth out the flow at this point. In the sketch, *A* shows the probable air flow conditions around an uncowled radial engine in the nose of a cabin monoplane. Considerable improvement is effected by the installation of a ring around the engine as shown at *B*, and figures *C* and *D* show the probable flow patterns after the installation of the auxiliary cowling at the windshield. In this case considerable more attention would have to be paid to the problem of pilot vision, but the suggestion gives an indication of what may be accomplished by extending the ring cowl theory to parts of the airplane other than the engine.

The Department of Commerce confers with manufacturers and transport operators about the conditions under which they are to do business

Remodelling Bulletins 7A and 7E

FOLLOWING established precedent, except for the time of year chosen for the meeting, Secretary Young and his co-workers in the Aeronautics Branch of the Department of Commerce met the airplane industry on July 31 to discuss the changes to be made in next year's edition of Bulletin 7A, "Airworthiness Requirements for Aircraft." Creating a new precedent, the meeting immediately followed a session between the Department of Commerce and the companies running transport airlines to talk over Bulletin 7E, "Air Commerce Regulations Governing Scheduled Operations of Interstate Passenger Air Transport Services."

The final sessions were preceded, as in the design discussions last year, by meetings for the manufacturers and operators alone under the auspices of the Aeronautical Chamber of Commerce. By thrashing out their differences in private the commercial interests found it possible to present a united front on most points when dealing with the government officials. The chosen spokesmen were Thomas B. Doe, president of Eastern Air Transport and chairman of the Air Transport Section of the Chamber, and Ralph S. Damon of Curtiss-Wright, chairman of the Commercial Airplane Manufacturers Section.

I
Transport Operation (7E)

THERE was only superficial similarity between the two meetings. The manufacturers were dealing with a document which has been in force for four years, with which they were all familiar through its rigorous application by the Department's inspectors and engineering section, and in which only minor adjustments were needed. The transport operators, on the other hand, were discussing a code which first came into existence in a very preliminary form about a year ago and which so far has only been given a very limited application. Naturally their discussion was more general in tone and directed to the fundamental principles of the regulation, whereas that of the manufacturers' representatives concerned itself largely with small details of wording. Another distinction between the two sessions was in the attendance. Whereas Bulletin 7A was debated by an almost homogeneous group representing the engineering departments of airplane manufacturers, the participants in the transport discussion included two distinct factions, the officials of airlines and the representatives of the piloting personnel. There were some thirty members in the first group and about a dozen in the second, and the twelve pilots from as many different lines, further backed by Carl Egge of the National Air Pilots Association, spoke primarily for the interest of the pilots as a vocational group.

In general, complaints were made against the present regulations and the proposed changes upon the ground of their too general application. The operators as a whole evidenced their preference for the treating of each line as a separate case. Some of those participating protested repeatedly that their conditions were so special that a general rule that might be a very wise one in the majority of instances would work great hardships in their particular cases.

Overhaul periods

There was general and vigorous objection to the rule, which was already in Bulletin 7E and had for some time been in force, that engines should be overhauled at least once each 400 hours. The operators objected to the setting up of any bar to progress, or any rule that would not permit of taking full advantage of increasing reliability and durability of equipment. It was argued that overhaul periods had been steadily lengthening, and various operators expressed the hope and the conviction that they would continue to lengthen, with 750 hours suggested as a figure that might reasonably be attained in the near future with perfect safety. They wanted to be allowed to fix their own overhaul periods notifying the Department of their decision.

The co-pilot

Grievances against the co-pilot requirement were also addressed rather to the existing form of the rule than to any changes that the Department proposed to make. A co-pilot is now required in any plane accommodating fifteen passengers or more, and the Department had planned to modify an additional stipulation so that he would also be called for in any case where the pilot had to fly more than 5 hours in any one day on eight-passenger planes or larger. The Chamber's preliminary meeting brought forth the suggestion that all mention of the size of aircraft be eliminated, the number of engines being substituted as a determining factor, and that a co-pilot should be required only in multi-engined airplanes and only there when the first pilot had to fly 6 or more hours in one day.

Some of the transport operators objected that the whole principle of the present regulation was unsound. They considered that it was no more fatiguing to fly a large plane than a smaller one, that the co-pilot was actually supplied to guard against the possible disability

of the first pilot, and that two or three passengers were just as much entitled to have their lives safe-guarded as were twenty or thirty. Others suggested that the co-pilot was needed on the multi-engined airplane not because of flying fatigue but to furnish an additional pair of eyes, one pilot keeping a lookout on each side. Several speakers protested that to require co-pilots would cause a tide of red ink to sweep over the books of account, while others emphatically objected to the suggestion that economy of operation might be a deciding factor where safety was at stake.

Working hours for pilots

The question of the amount of flying that a pilot could do with safety came up inferentially in discussing the co-pilot specification. It came up directly in connection with the Department's proposal that if a pilot's duty time exceeded 6 hours in any one day he should have at least a 20-hour period of rest before starting again, or that as a special case he might fly between 6 and 8 hours on two successive days if he then received 40 hours rest. To that suggestion there was general opposition, both from the operators and from the pilots. The operators proposed reducing the minimum rest periods from 20 and 40 to 12 and 24 hours, but the pilots made more sweeping criticisms and preferred to have simply a limitation on total monthly flying time, to about 100 or 120 hours. They complained that the Department's proposal might result in stranding a pilot away from home for his rest period, where by doing a little more flying than the present rules would permit he could get to his home station and thereby get much more good from his rest. [K.L.M., the Royal Dutch Airways, have made extended experiments on "staleness" and have recently raised the limit in some cases to 150 hours a month as a result.—Ed.]

Certificates of competency

The liveliest controversy of all was aroused by the proposal for a special certificate of competency for airline pilots. The Department had suggested, as a tentative basis of discussion, a minimum age of 24 years and a minimum total flying time of 1,500 hours, of which at least 300 hours must have been cross-country and 50 hours at night. Blind-flying experience and an examination on advanced meteorology and navigation and some other subjects would also be required. The operators objected to all this and recommended that it be left to the responsible officials of the line to select pilots qualified for their particular operation. They considered the present transport license an adequate minimum standard for imposition by the Department. Secretary Young assuaged some of their fears of complications by pointing out that the requirements of the certificate would not be retroactive, and pilots now employed would in any case be able to keep on with their work. Several speakers called attention to the peculiarities of their operations, which would make it difficult to determine the qualifications of pilots by any general set of rules, and some suggested that a series of special ratings be given under the transport license as showing experience in special types of flying. John B. Kohler of Kohler Airlines, for example, cared little for night-flying experience in his pilots, but considered specialized experience or training in over-water flying of the greatest importance.

The pilots were naturally very actively interested in the proposal, and on the whole sympathetic to the new plan, although most of them objected to the term "certificate of competency," with the implication that the man who had had a little less than 1,500 hours was necessarily incompetent. They would prefer an entirely new type of license, perhaps to be called a master pilot grade. R. L. Wagner of Boeing Air Transport, representing their collective view, suggested that the minimum age stipulation be abolished, that there be at least 2,000 hours of flying required, including at least 500 solo or as first pilot, and that 250 hours of night flying, all of which might be done as co-pilot, be the minimum. The pilots preferred to eliminate the written examinations, except perhaps on meteorology and navigation, not including celestial navigation. Mr. Egge would like to see night flying abandoned as a definite requirement, being kept as a special rating for those who engage in that type of work. He was protecting the interest of the pilot at present employed by a private or industrial owner, getting a good and varied experience but one including little or no night flying. He thought such pilots should be eligible for airline employment. Paul Braniff of Braniff Airlines agreed with the pilots about minimum age, suggesting that it be dropped from 24 years to 21 on the grounds that a boy might well start flying at 17 and that four years' experience was ample to qualify him as a first pilot.

The question of stewards, like that of co-pilots, is recurrent in all discussions of the economy and safety of airline operation. The Department has called for a steward in all aircraft having a passenger capacity in excess of eight. The Chamber of Commerce meeting requested the elimination of the requirement as having no direct bearing on safety, and Secretary Young tentatively concurred, although there have been several cases of a passenger becoming violent and having to be subdued by force.

Bad-weather flying

Operating rules occasioned less active controversy than might have been expected in view of the introduction of an entirely new section covering the conditions under which it is permissible to fly above solid clouds or fog. The Department had drafted a rule prohibiting any operation over clouds unless machines should have two-way radio, and then only when the ceiling at the terminal airport was known to be at least 300 ft.; or alternatively, unless the ceiling were at least 2,000 ft. along the entire route at the time of taking off. The operators' view was that each line had to be considered as a special case and that each line should draw up rules of its own satisfactory to the Department. Mr. Manning objected to a general stipulation of two-way radio, feeling that one-way radio might be quite adequate in some cases. The 500-ft. altitude rule, promulgated in January, 1930, was challenged at this meeting for the first time. The operators suggested that the minimum permissible to be reduced to 300 ft. and that ground conditions and visibility as well as ceiling should be taken into account in determining when the pilot would have to turn back or land. Secretary Young pointed out that the 500-ft. level was tied into the general law of property rights in air space, having been recognized in various court decisions, and that it would be impracticable to make any general reduction from that figure, but he conceded the possibility of special modification in special cases.

Radio provision closer

Universal requirement of radio continues on the horizon, but much closer at hand than it was a year ago. The Department's new draft proposed that two-way radio equipment should be required in all planes of eight-passenger capacity or more wherever suitable ground facilities exist, but permitted the exception that a proper visual signaling system acceptable to the Secretary of Commerce might be used in place of regular radio communication. The operators again proposed that individual differences between lines be taken into account, and that two-way radio should be required only where its necessity to the particular operation should have been shown.

Statistics

Among the variety of other small points brought up during the meeting or covered in the Department's suggested amendments, most interesting to the aeronautical world at large was the provision designed to improve the quality of air transport statistics and to keep them more closely up to date. The Department proposed that each operator should make a statistical report every month. The operators suggested that the interval be quarterly instead of monthly, and that duplication be avoided by agreeing on a form of report that would satisfy the requirements

both of the Post Office and of the Department of Commerce. Secretary Young readily agreed, and a special committee went to work on the problem.

The meeting was conducted and closed in the usual supremely amicable atmosphere, and Captain Doe expressed to the press the transport operators' appreciation of the opportunity for so frank a discussion and their full acceptance of the fundamental principles of federal regulation of air transport.

II
Design and Manufacture
(7A)

THE industry's approach to the airworthiness requirements has been more systematic this summer than on any previous occasion. An engineering committee, with Mr. Arcier of Waco as its chairman, has been at work for several months drafting recommendations for amendments. The Department of Commerce completed its own first draft of proposed changes late in June. Both sets of recommendations were distributed by the Chamber of Commerce to the industry. The observations and criticisms thereafter made by various engineers had also been circulated. When the manufacturers' representatives met in Washington on July 29 they had very definite agenda before them.

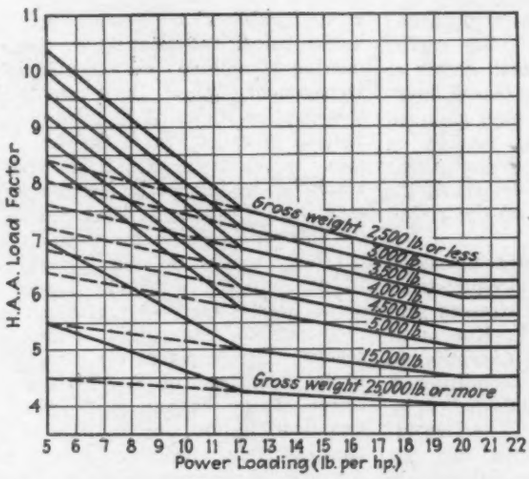
Load factors on wings

With the exception of two stipulations applying only to wire-braced monoplanes, the changes in structural requirements are not of very far-reaching importance. The Department proposed a new practice for dealing with multi-engined machines, affecting especially those of highest power and speed. The net effect of the revision was to raise the required high-angle load factor from approximately 4.55 to 4.82 in a Wasp-engined Ford, and from 4.35 to 4.60 in a Curtiss Condor. Single-engined planes of the same gross weights would have to be designed for 5.3 and 4.95, respectively.

At the same time, new curves of load factor against power loading were introduced (reproduced on this page). With the power loading in excess of 12 lb. per hp., no change was made, but at that point a break was put into the curve, so that a Consolidated Fleetster, for example (taken as having a lower power loading than any other cabin machine listed in AVIATION's specification table), would have to have its high-angle load factor raised from 5.8 under the old rule to 6.45 under the new.

The Department had suggested a further stiffening up of the requirements, in the light of recent accelerometer studies and other researches, on the low-angle factor. They proposed that it should be 70 per cent of the high-angle figure with a minimum of 3.25, instead of 65 per cent with a minimum of 3.0 as in the past. A number of designers, both of large and of small airplanes, objected that no necessity for this had been shown and that there had been no structural failures in machines properly designed according to the present rules. The manufacturers' meeting unanimously requested that this change be abandoned for the time being, and Secretary Young and Mr. Gazley agreed.

At this point several engineers protested against the piece-meal method of strength specification, with each part of the airplane and each factor considered as a distinct problem. It was agreed that the time had come for basic reconsideration and revision of load factors, starting from fundamentals and taking into account the whole existing store of research and experience, and it was suggested that the Department of Commerce and the industry join in asking the National Advisory Committee for Aeronautics to take the lead in planning for such a study. It was further suggested that the National Advisory Committee be asked to extend the acceleration tests now being made on regular transport planes of the Boeing Line to other air transport lines, bringing in other types of terrain and of equipment. All this was entirely agreeable to the Department.



New curves of load factor against power loading. In power loading over 12 lb. per hp. no change was made

Wire-braced monoplanes

Several new stipulations of arbitrarily increased load factors or margins of safety were introduced to apply to types of structures considered particularly liable to vibration or other incalculable troubles. It was there that the monoplanes with external wire bracing particularly suffered, for the Department called for a 100 per cent extra margin of safety in all external brace wires of such machines. The manufacturers, and especially Mr. Galloway, representing the makers of the Aeronca, protested. It was argued that the troubles which the change was desiring to meet were not characteristic of all wire-braced monoplanes, but only of those with a very flat wiring angle. It was suggested that an analysis of deflections in the truss should be required wherever there seemed to be likelihood of danger, and that the maximum permissible deflection should be specificed. Mr. Gazley thought that quite impracticable in the present state of knowledge. It was argued, by Roy G. Miller of American Airplane and others, that arbitrarily increasing the strength of the wires might actually be a danger factor, as the structure might be overstrained in tuning it up. The Department took all this under advisement, but declined to make any immediate concession. They declined to yield also on a provision that on a wire-braced monoplane there must be a rigid cabane above the wing, so that the right and left sides of the bracing will be completely independent of each other when dealing with unsymmetrical loads.

A similar requirement for extra strength, but in this case based on the fear of rapid deterioration, calls for a 20 per cent extra margin of safety on all ribs. Some of the manufacturers doubted the need, but they decided to let it pass without formal objection.

Landing loads

The specified methods of applying a side load on the landing gear of a plane, and also of applying braking loads, were modified to reduce somewhat the severity of the provisions. The exact percentage of reduction would depend on the type of structure.

The Department proposes in the future to take account of the extra springing qualities of low-pressure tires, and the new draft of 7A permits an arbitrary reduction by 35 per cent of the bending limit in axles and landing gear struts when extra low-pressure tires are used. The new allowance is made to permit

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the substitution of low-pressure tires on a standard landing gear in place of the high-pressure type. The wider tires work at a larger moment arm than the narrow ones, and without some such allowance as is proposed the substitution would have the apparent result of increasing the bending moment in the landing gear to above the maximum that it is designed to stand.

The manufacturers requested, and Secretary Young accepted, a modification in the specifications for structural analysis in the dive condition, making them somewhat more lenient than before. In the past the fundamental assumption has been that the front spar carried a down load equal to that required in the inverted flight condition, and all other loads were then calculated to give equilibrium. This led to enormous tail and fuselage loads in some cases, particularly where the front and rear spars were widely separated in the wing. The new provision makes the tail load the basic factor, setting it equal to the maximum that the tail itself is designed to stand. Both the new and the old conditions are very unfair to wings with convex lower surfaces or upturned trailing edge, or for any other reason having an exceptionally small center of pressure travel. For some reason, however, the Department has never accepted the mathematically sound method of working out loads in the diving condition from a wind tunnel determination of the moment coefficient on the airfoil at zero lift.

The last structural point discussed was the calculation of monocoque structures, and of the effect of stressed skin plating in general. B. V. Korvin of Edo Aircraft took violent exception to the present practice of permitting a shear stress of only 2,500 lb. per sq.in. in aluminum alloy plating. The Department's representatives pointed out that the present regulation was deliberately designed to be very conservative, and was only to be used by designers who were willing to sacrifice something in efficiency in order to escape the expense of a static test on the completed structure. It was always open to them to make a static test and to secure credit for all the strength that the structure actually possessed.

Materials

The specification and the use of materials played a somewhat larger part than last year. An entirely new code was established for determining the minimum permissible diameters and wall thicknesses of steel tubes. The minimum permissible wall thickness of all steel tubing will be .035 in. (20 gage) in all cases, except that .028 in. tubing (22 gage) may be used in the fuselage behind the pilot's cockpit and in secondary structures if a minimum margin of safety of 50 per cent is maintained. The minimum permissible outside diameter will be $\frac{3}{4}$ in. in longerons and engine mount members and $\frac{1}{2}$ in. elsewhere, except on light planes where no direct minimum is imposed.

The Department's original draft contained a stipulation that there should be no heat treatment of chrome molybdenum steel tubes of wall thickness of less than .065 in. (16 gage), but there was strenuous objection to that. It was pointed out that that would practically eliminate the possibility of using steel-tube wing spars, and the proposal was withdrawn.

The use of castings is specifically covered for the first time in a new provision permitting their employment in the primary structure only if there be a margin of safety of 100 per cent or, in other words, if they be designed for twice the normal load factor. The reason for the handicap, of course, is the fear of unsuspected flaws in the casting.

Detail design

There was the customary profusion of provisions on details of design and layout and aerodynamic performance. The most notable change, suggested some weeks before the meeting by the engineering committee and accepted by the Department, puts the rate-of-climb specification in terms of landing speed. Instead of calling for a flat 400 ft. per min. at sea level as in the past, the climb for landplanes in feet per minute must henceforth be at least eight times the theoretical minimum speed in miles per hour, and in no case less than 300 ft. per min. For heavily loaded machines this is more severe than the old requirements, for light planes less severe. For seaplanes the coefficient is to be 6 instead of 8. The essential result of the change is to make the specification more one of angle of climb than of rate of climb, and thus to bring it nearer to the form of the requirement of the International Convention for Air Navigation, accepted in most European countries. The new landplane specification is approximately equivalent to an angle of climb of one in 13.5, or to the ability to climb to 100 ft. altitude in a quarter of a mile after taking off.

The Department proposed no change in landing speeds, but the manufacturers pressed a request that the minimum for seaplanes be raised from 65 to 70 m.p.h. There was much argument about the request, and it was urged that seaplanes have an unlimited area for forced landings, that the only serious hazards are in take-off, where the pilot can choose his own conditions, that racing seaplanes have been able to use higher landing speeds than have ever been employed in racing landplanes, and so on. Leading parts in the discussion were taken by Mr. Cocklin of General Aviation, R. H. Depew of American Airplanes, N. N. Sinitzin of Sikorsky, and the editor of AVIATION. Secretary Young remained very sceptical.

Retractable landing gears

The discussion of retractable gears brought out a variety of anecdotes of pilots who had persisted in landing with the wheels up in spite of every sort of indicator that could be provided. It was finally agreed that a cockpit indicator to show the wheel position should be required, except in those cases in which it could be positively determined by direct inspection from the cockpit whether or not the wheels were in their correct landing attitude.

R. B. C. Noorduyn, representing Bellanca, started a debate on the question of emergency exits. The present rule calls for one exit for every six occupants, and the Department proposed no change, but there were some complaints that this was unduly severe on the large planes. The suggestion that came from the industry's meeting was that there should be at least two exits in all cases, and that in a cabin providing for more than fifteen occupants there should be at least one additional way out. Emergency exits might be placed either in the side or top of the cabin. The Department took the suggestion under advisement without any definite hostility, but apparently somewhat doubtful of the adequacy of the suggestion for very large planes. The existing minimum size, 14x20 in., was enlarged to 17x24, on the protest of an exceptionally broad-shouldered engineer that he couldn't get through emergency exits as now built.

Floats and hulls

The session included the usual highly-specialized argument between the Department and a small group of engineers representing manufacturers of seaplanes and amphibions. A special committee, headed by Mr. Stalb of Aircraft Products, had prepared a set of recommendations loosening up the present rules on water-tight subdivision. It is now required that flying boats shall remain afloat with any two compartments flooded. The committee suggested that for machines of less than 5,000 lb. gross weight only one compartment should be considered to have filled, and the Department accepted that. When they went further and proposed that for light seaplanes under 1,500 lb. gross weight there need be no water-tight subdivision at all, Secretary Young asked for new evidence to justify such a change. The best argument of the seaplane builders was that their craft, when on the water, were subject to dangers inherently no greater than those confronting high-speed motor boats, and that untold thousands of boats were being run from 30 to 50 m.p.h. with no pretense of water-tight subdivision. The Department reserved judgment on that point, as they did on another suggestion that approved air bags might be substituted for water-tight compartments.

Management of an airport is management of a business enterprise. Methods must be business-like throughout, with no dependence upon special blessings accruing from the glamor of aviation

Airport patronage promotion

At most ports the day of promoting patronage by means of heavy circus and ballyhoo stunts is passing rapidly, if it has not already gone

At most ports the day of promoting patronage by means of heavy circus and ballyhoo stunts is passing rapidly, if it has not already gone. There is a limit to the number of times that any one individual can be brought out to see a stunting show and a parachute jump. But the need for patronage stimulation is keener than ever, compelling the progressive manager to adopt modern, intelligent, novel measures to maintain a satisfactory flow of business.

Patronage promotion as a rule does not need to worry the managers of municipal airports for they are considered as public necessities, somewhat in the nature of water terminals or highways. It is the pet worry of the operator of a commercial field, obviously an enterprise in which a return is expected some time on a sizable investment, and of the commercial operator on a municipal airport, since his income is derived from commercial operations.

Experience has revealed six chief problems: Attraction of charter and sightseeing passengers; enrollment of students; sale of planes; attraction of visiting pilots; enrollment of companies as new tenants on the field,—such as airline operators, manufacturing firms and miscellaneous operators—and development of miscellaneous income sources—such as concessions, restaurants and hotel. Solutions are numerous, their value varies directly with their applicability to the individual airport.

Substitutes for joy-hops

The old joy-hopping industry has waned all over the country and a substitute had to be devised in order to prolong the short flight business, not long ago a veritable gold mine. Roosevelt Field at Mineola, L. I., has developed two schemes: one a series of sightseeing trips over definitely prescribed courses and points of interest which would appeal to the average spectator; the other a group visitation to the airport by clubs, lodges, high school classes, etc., for a four-hour period which includes transportation by bus to and from the field, inspection of the port, a sightseeing flight and luncheon. The first plan has been widely used at other ports adjacent to great cities of areas of scenic interest, but the second expedient is unusual if not unique.

Most popular sightseeing trips are those over Long Beach, on the southern shore of Long Island, and over New York City. Patronage of the sightseeing flights is stimulated at the airport through the public address system (an excellent sales medium), and by special flying exhibitions staged on holidays and week-ends. These, always including parachute jumps, are about the only feature with the old circus flavor. The jumps are demanded by the public, at least by that particular field's public; omission has always been followed by a sharp drop in attendance.

The group visitation plan reaches beyond the airport boundary and is promoted by a pamphlet mailed to lodges and other organizations in the metropolitan area. The visit is emphasized as an interesting form of outing. A full afternoon's program, including the transportation to the field, the sightseeing flight, inspection of the buildings

and equipment, and a luncheon is provided to the group at a rate per person equal to that of the flight alone when undertaken on an individual basis.

Westchester Airport at Armonk, N. Y., is another which has substituted sightseeing flights for the old-fashioned joy-hop. Promotion is aimed at both those visiting the field and groups not ordinarily coming in contact with it. An attractive four-page folder, describing four special "tours" over points of scenic or personal interest, carries the sales talk abroad to members of clubs in Westchester County, and is distributed among spectators in the airport parking areas. Five thousand copies cost only about $75 to prepare.

The folder resembles closely a leaflet from a conventional travel agency. The fifteen-minute flight over Playground, county amusement park seven miles away, costs $3 in a three-place plane and $5 in a two-place machine. The 30-minute flight to Bear Mountain Bridge, a popular point on the Hudson River, costs $10 single fare or $6 per person in a party. An hour's trip to the Statue of Liberty, along the Hudson and over Manhattan costs $20 per person when alone, or $10 per person in a party. The fourth option is a trip over the patron's own country club or residence, for which special rates are quoted on request. The opportunity of seeing points of particular personal interest from the air is stressed in all promotion. The trips for one person are not flown after 2 o'clock on Sunday or holiday afternoons, and the party rates on those days are increased slightly.

There are other new wrinkles. Nemhamco Flying Service operating seaplanes at the Weirs on Lake Winnepesaukee, varies its sightseeing tours by an altitude flight on clear days to 10,000

Descriptive folders of the Boston Chamber of Commerce and the Industrial Club of St. Louis

Roosevelt Field offers outing accommodations to clubs and groups

ft. Harry J. Hermann's flying service operating at Bowles-Agawam (Mass.) Airport has attracted short-ride patrons to the port through informal flying meets in which a number of students and local non-professional pilots participate. William Sewall, of the William Flyers, operating at Edgartown on Martha's Vineyard, introduced a distinct novelty in his short hop during the summer by holding his Bird close to the stalling point in a moderate breeze and allowing it to float sideways with the wind across the airport.

By still other means it is necessary for the modern airport to cultivate its public. For instance, many issue pamphlets or folders describing in detail the layout of the field, the equipment installed thereon and the companies, including airline services, which use it. The folders issued by the Boston Municipal airport and the St. Louis Chamber of Commerce described in the August issue of AVIATION are examples. Roosevelt Field supplements its general pamphlet with one describing the hotel and restaurant service at the field. These stimulate interest in the field, always an indisputable asset, and prepare the ground for more tangible results in various forms of patronage.

The search for students

Those brief, golden days when flying students flocked to the airports for instruction and which led to the plotting of many elaborate training curricula, have gone the way of the joy-hopping boom. Students have to be sought almost as assiduously as the purchaser of an airplane. This calls for wide-spread advertising, and pursuit of leads by trained salesmen, aided and abetted by more pamphlets setting forth the offerings of the school. The Westchester port has centered its campaign, by mail, on the student-permit holders in the New York area who have not yet, according to the official records as distributed by the Aeronautical Chamber of Commerce, secured a private rating. In the belief that many of these have dropped by the wayside temporarily because of discouragement, momentary lack of money, or some such factor as geographical inconvenience of the flying school originally selected, the management sent out folders pressing consideration of its facilities. A business return card was enclosed, and on the return of a card a salesman at once went into action by telephone. The compaign had very encouraging results.

Not all student promotion need be as highly organized as this. One interesting method tried out by Northeast Flying Service at Manchester, N. H., was an air picnic in which the pilots of the company, the school's solo pilots and the other students flew 125 miles in open and cabin planes to Twin Mountains, where the group had lunch, and then returned to the base. The trip combined cross-country experience for the students with some excellent publicity for the course among the wealthy residents of a popular summer resort, people some of whom were already casting about for ways of passing the days without playing golf.

The airport's "commodities"

Airports have two classes of customers—the public and those in the industry. Beside rides and instruction, its "commodities" include fuel, service, repairs, housing supplies and allied items. Pilots and owners of aircraft, therefore, form a very important portion of the port's clientele. National advertising is used in some cases to induce the pilots and owners to make a certain port their point of call on a cross-country trip or a permanent base, and this, again, is often supplemented by appeals through the mail. Robertson Aircraft Company at Lambert-St. Louis Airport has been particularly aggressive in calling attention to its sales and servicing facilities on that municipal port. Many pilots received the invitation sent out by the Wayne County port to base there while attending the 1931 National Aircraft Show. Roosevelt has included in these contacts the jobbers and manufacturers who might become tenants of the field.

Airplane sales

Plane sales—of both new and used models—get the direct attention of the commercial operators at large ports and of the managers of the smaller fields. Westchester follows up all its other contacts with periodical mailing of business reply cards on which are listed the used machines available through its organization and the asking prices. The cards are sent to pilots, students, mechanics and owners in the area immediately contiguous to Westchester. Sales of at least three planes last autumn were traced to such solicitation.

George Wies, Inc., at Roosevelt Field, also has adopted the policy of meeting the local prospects on their own ground and keeps a select list of them posted by a mimeographed form letter. Even to keep up plane sales at the present somewhat unsatisfactory rate requires effective sales effort in the prospect's own territory. No longer is it possible to sit in an office or cockpit while the eager prospect seeks out the planes which may be purchasable.

The used plane market is being recognized as being a promising income source for the average operator. However, only standardization of good business practices in this field can win and hold the confidence of the buying public, and yield the hoped-for volume of financial return. The horse-trading tendencies of many dealers operating under the prevailing haphazard methods must be modified for the good of all concerned, and most particularly for their own good. The average prospect for a used plane these days, to the distinct detriment of the business, faces a deal of sharp trading with which he is not equipped to cope unless he happens to have had a thorough experience in aeronautics.

The friendly press

Aviation activities have been popular with the press for a number of years and airport executives have easily maintained close relations with the press as one of its best publicity media. This extreme popularity will not last forever. Many of the larger airports maintain special quarters for the use of the press and some are "covered" on a full-time basis. Roosevelt is one of these, but even this representation is supplemented by a weekly mimeographed summary of news items which is sent to publications over a wide area. Though these sheets may not be the direct source of printable news, they do serve the useful purpose of keeping editors and reporters acquainted with what is going on at the field and in that way secure additional good-will.

Every person receiving a letter from the Westchester field is told about the field's services at the same time. This is accomplished by a newly adopted letter form which consists of four pages, three of which are devoted to text and photographs. The first page has space for the letter. The double inside spread describes the plant in detail, and the back pages present a summary of operations. Two colors are used in printing.

Willingness to try anything

The efficiency of non-aeronautical concessions in building up the airport attendance and income has been the object of much study in recent years. Willingness on the part of scores of managers to try anything promising accounts for the presence of Tom Thumb golf courses, swimming pools, tennis courts, automobile filling stations and other attractions at certain ports. The foremost exponent of this idea is the Central Airport at Camden, N. J., which has been quite successful. It stands as the exception as well as the example, however. The tendency today is toward concentration on the strictly aeronautical elements and those common to any activity—such as the eating facilities, parking, occasional hotel accommodations, communication facilities, and the like.

The Cabot pick-up in action

An aerial pick-up device

WITH increasing volume of mail and express being transported by air, it becomes apparent that devices must be perfected to permit airplanes in flight picking up cargoes from the ground if service is to be made available to localtes where geographical conditions make it impractical to land airplanes regularly. A device of this sort has been developed and demonstrated by Mr. G. L. Cabot and the Aero Pick-up Service Corporation of New York. Transfer of packages from ground to plane is accomplished by engaging a grappling hook trailing below the machine with a pick-up rope attached to the package. The rope is supported between two 16-ft. uprights attached to a catapulting machine in such a way that as soon as the contact is made with the hook the pick-up cord is disengaged from the upright and the package of goods is catapulted on a 12-ft. track in the line of flight at a speed equal to that of the airplane. At the instant when the transfer is made the package and the airplane are traveling in the same direction at the same speed and the flight of the machine is undisturbed.

The device shown in the accompanying photograph has been used for picking up packages up to 40 lb. in weight. It is claimed that machines of the same principle can be built to transfer loads of as much as 1,000 lb. without danger.

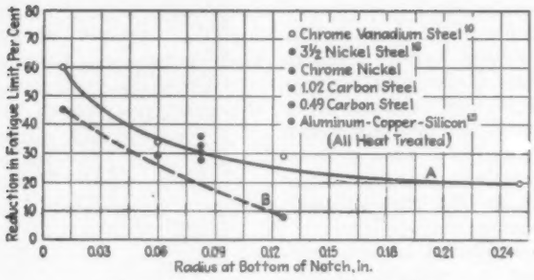

Fig. 5—A Steel, B Aluminum Alloy

Fatigue of aircraft parts

The second of two articles

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UNDER-STRESSING is the application of repeated stresses at, or just below, the fatigue limit. It has an effect similar to cold work, increasing the tensile strength and fatigue limit and reducing the ductility. The increase is small for heat-treated steels, but in the case of 18 per cent chromium, 8 per cent nickel, previously cold drawn, specimens which had been run for 100,000,000 cycles at the fatigue limit (62,000 lb. per sq.in.) were run at 70,000 lb. per sq.in. for 5,000,000 cycles. A further increase to 72,000 lb. per sq.in. resulted in failures between 75,000 and 100,000 cycles. The F. L. of cast iron has been increased 30 per cent[11] and chrome-molybdenum cast steel has been increased 20 per cent.

Over-stressing is the application of original stresses higher than the fatigue limit. A few experiments[1] indicate that a specimen may be over-stressed for a limited number of repetitions without decreasing the fatigue limit. For an S.A.E. 1050 steel an over-stress of 10 per cent and 20 per cent for 5,000 cycles caused no weakening, but when the stress was 29 per cent over the normal fatigue limit there was a reduction of 11 per cent. Higher stresses could be applied for shorter periods with no weakening effect. Sufficient over-stress to start an actual fatigue crack will undoubtedly lower the fatigue limit. If a crack is started it can sometimes be detected before failure occurs (Fig. 4). This is especially true on large parts. Coarse etching aluminum alloy propeller blades after about 100 hours service is now standard practice and in several cases incipient cracks have been discovered which were not in the propeller on original inspection. These may be caused by over-stressing due to concentration of stress as they often occur at fillets, bolt holes or surface irregularities.

Table 4: Estimated maximum percentage reduction in fatigue limits compared with standard polished specimens

Type of finish	Moore and Komers Bulletin No. 124 University of Illinois	W. N. Thomas R & M No. 860 Aero. Research Committee
No. 0 and No. 00 emery cloth	0	....
Fine emery	..	2–3
Ground fine	..	4
Ground on wheel	11	....
Smooth file	..	7.5
Smooth turned finish in lathe	14	12
Rough turned finish in lathe	18	....
Coarse file	..	18–20

The wide scatter of the individual results for aluminum alloys masks the effect of under-stressing and over-stressing in laboratory fatigue tests.

The procedure used to determine the effects of under-stressing and over-stressing is more in the nature of a laboratory experiment and its principal significance to the engineer is the indication of the weakening or strengthening due to variable service loads.

Surface irregularities

Surface irregularities include those which are necessarily a part of the design, such as, holes, notches, threads, keyways and fillets and those introduced during fabrication of the raw material, such as scratches, seams, pits, blowholes and foreign particles and which are practically unavoidable in commercial material.

Any variation in the surface structure affects the distribution of stress and causes a localized increase at the edge of the hole or the bottom of the thread. The theoretical value of this stress has been determined mathematically, assuming a steadily applied load below the elastic limit, but the calculated values do not check the empirical data obtained by several investigators.

The maximum stress at the edge of a hole occurs at the transverse diameter and mathematically is equal to three times the mean stress. Experiments on sheet with drilled holes[38, 1] give erratic results with reductions varying from 1 to 20 per cent but never reaching the

Table 6: Properties of aircraft metals

Type	SAE No.	Carbon	Manganese	Chromium	Nickel	Other elements	Size stock	Treatment (degrees Fahrenheit)	Tensile properties (lb. per sq.in.) Ult. str.	Yield point	(per cent) Elong. in 2 in.	Red area	Fatigue limit (lb. per sq.in.)	F.L./T.S.	Authority*
Low carbon	1020	0.20	0.65	.....	.....	.....	½ in. rd	Cold Finished	62,300	.....	.....	.....	33,000	0.53	1
Half hard carbon	1050	0.52	0.56	.....	.....	.....	4 in. sq.	H 1450 QW D-1200	111,400	80,300	22	57	55,000	0.49	1
Hard carbon	1050	0.55	0.74	.....	.....	.....	2 in. sq.	H 1550 QW D-1200	106,850	73,550	24	57	57,000	0.53	2
Carbon	1050	0.53	0.48	.....	.....	.....	.....	H 1450 QO D-1000	110,000	72,000	14	58	58,000	0.53	3
High carbon	1095	0.93	0.38	.....	.....	.....	2x¾ in.	H 1450 QO D-850	188,000	97,200	10	29	98,000	0.52	1
3.5 nickel	2340	0.41	0.75	0.18	3.41	.....	1 in. sq.	H 1450 QO D-1000	148,500	135,800	13	58	78,000	0.52	1
Chrome-nickel	3140	0.38	0.66	0.80	1.56	.....	Bar	H 1550 QW D-1100	132,900	117,600	22	57	67,000	0.51	4
Chrome-nickel	3250	0.49	.....	0.99	1.75	.....	Bar	H 1550 QW D-900	164,500	128,000	115	53	84,500	0.51	4
Chrome-vanadium	6135	0.40	0.64	0.93	.....	V 0.20	Bar	H 1650 QO D-1150	145,500	130,000	18	58	62,000	0.43	5
Chrome-vanadium	6150	0.55	.....	0.99	.....	V 0.19	Bar	H 1650 QW D-900	201,000	165,000	13	54	94,500	0.47	4
Chrome-molybdenum	4130	0.30	0.67	0.71	.....	Mo 0.28	½ in. rd.	H 1625 QO D-1100	130,000	115,000	19	65	74,000	0.57	2
Chrome-molybdenum	4130	.....	.....	0.71	.....	.....	½ in. rd.	H 1625 QO D-900	152,000	137,000	15	60	85,000	0.56	2
Chrome-molybdenum	4130	.....	.....	0.71	.....	.....	½ in. rd.	H 1625 QO D-650	205,000	187,000	.....	8	99,000	0.53	2
Carburized	1020	0.15	0.69	.....	.....	.....	Case 0.047 in.	Carburize 1650	117,000	.....	.....	.....	85,500[1]	.....	6
	.....	.....	.....	.....	.....	.....	.....	Refine core 1650, Case 1400	.....	.....	.....	.....	.....	.....	6
Carburized	2320	0.17	0.25	.....	3.60	.....	Case 0.047 in.	Carburize 1650	184,000	.....	.....	.....	119,000	.....	6
	.....	.....	.....	.....	.....	.....	.....	Refine core 1580, Case 1380	.....	.....	.....	.....	.....	.....	6
Carburized	2512	0.13	0.16	.....	5.10	.....	Case 0.047 in.	Carburize 1580	.....	.....	.....	.....	.....	.....	6
	.....	.....	.....	.....	.....	.....	.....	Refine core 1580, Case 1350	195,000	.....	.....	.....	123,000	.....	6
Nitrided	.....	0.35	0.54	1.67	.....	A 10.91, Mo 0.20	½ in. rd.	Nitrided 90 hours @ 950	162,000	140,000	6	8	84,000	0.52	7
Chrome-molybdenum	.....	0.39	1.39	0.62	.....	Si 0.43 Mo 0.29	Casting	H 1800 QA H 1600 QO D1275	112,000	85,500	20	49	51,000	0.46	2
Elements															
Copper (Copper 99.9), See Fig. 2, AVIATION, August, 1931	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brass (Copper 65, Zinc, Rem)	.....	.....	.....	.....	.....	.....	Sheet 0.02 in.	Annealed 1112	46,000	32,000	58	.....	12,000	0.26	8
Bronze, Phosphor (Copper 92, Tin 8)	.....	.....	.....	.....	.....	.....	Sheet 0.02 in.	Hard rolled	124,000	.....	2	.....	24,500	0.20	8
Aluminum (Aluminum 99)	.....	.....	.....	.....	.....	.....	Bar	Half hard	20,000	.....	5	.....	7,000	0.35[2]	9
Duralumin (Cu 4, Mg 0.5, Mn 0.7, Al Rem.)	.....	.....	.....	.....	.....	.....	½ in. rd.	Annealed	33,800	8,300	22	37	12,000	0.36[3]	2
Duralumin (Cu 4, Mg 0.5, Mn 0.7, Al Rem.)	.....	.....	.....	.....	.....	.....	.....	Heat-treated	59,300	27,800	18	46	14,000	0.24[3]	2
Nickel (Nickel 99)	.....	.....	.....	.....	.....	.....	1 in. sq.	Annealed 1400	77,600	22,000	49	75	33,500	0.43	4
Monel (Nickel 68, Copper 30)	.....	.....	.....	.....	.....	.....	1 in. sq.	Annealed 1400	81,900	31,000	49	74	36,000	0.44	4

[1] Case 0.020 in.—56,000—Moore, H. F. [2] 350,000,000 cycles. [3] 500,000,000 cycles. *Authority: 1 H. F. Moore, 2 Wright Field, 3 W. H. Hatfield, 4 D. J. McAdam, 5 Gillette and Mack, J. G. R. Woodvine, 7 Mochel, 8 Townsend and Greenal, 9 Templin

theoretical value. Tests on round rotating beam specimens with a ratio of specimen diameter to hole diameter of about 5, the hole being perpendicular to the axis and in the middle of the specimen, indicate reduction of from 35 to 50 per cent for steel[1], about 33 per cent for a rolled magnesium alloy (96 Mg 3.5 Al 0.25 Mn) and 40 per cent for aluminum forging alloy (95 Al 4 Cu 1 Si).

The stress in a sharp corner is theoretically infinite and although it is impossible to produce a sharp corner in practice, the stress still remains very high unless use is made of very liberal fillets.

A square notch in heat-treated steel reduces the fatigue limit from 45 to 50 per cent, according to several investigators. For soft steel and Armco iron the reduction is generally less. Kommers[11] reports a reduction of 29 per cent for Armco iron compared to no reduction for cast iron. He explains the latter result on the basis that "the concentration of stress at the corner of the square notch is no more serious than the carbon notch (due to graphite flakes) originally in the cast iron."

As a result of investigation[12], using soap films to determine the distribution of stress, it was recommended that the radius between the bottom or sides or ends of a keyway should not be less than one-fifth of its depth. Stanton and Batson[7] made fatigue tests on specimens cut from aircraft engine crankshaft forgings and found that assuming a fillet of ½ in. causes no reduction in the fatigue limit, that decreasing the fillet to ⅛ in. and 1/16 in. reduced the fatigue limit approximately 13 per cent and 43 per cent, respectively. The material was an alloy steel with a tensile strength of 139,000 lb. per sq.in., a yield point of 116,000 lb. per sq.in. and an elongation of 18 per cent.

The surface finish on a test specimen or service part will naturally have considerable effect upon the fatigue limit. Two series of experiments on the effect of various types of finishes are shown in Table 4. The series shown on the right were made on an S.A.E. 1050 steel and those on the left on low carbon steel, cast iron, aluminum and tool steel. The results are in good agreement and indicate the importance of a high polish on engine parts, such as crankshafts, piston pins and parts subjected to repeated stresses. Rough machining may cause sharp notches several thousandths inches in depth. The reduction of the fatigue limit is affected both by the depth and the radius at the bottom of the notch. The results of tests made at Wright Field on heat-treated S.A.E. 6130 steel and aluminum-copper-silicon alloy used for propeller forgings are indicated in Fig. 5. There was very little difference between vee notches and those with one perpendicular side and one side at an angle, such as a buttress thread. The radius at the bottom was the determining factor.

Table 5: Effect of vee notch on fatigue limit of different kinds of materials Radius at bottom of notch, 0.01 in.[10]

Material	Reduction (per cent)
Aluminum (rolled)	63
Magnesium (extruded)	62
Iron, Armco (rolled)	60
Al 95 Cu 4 Si 1 (extruded)[a]	55
Al 10 Cu 90 (cast)[a]	15
Al 10 Cu 90 (extruded)[a]	41
Mg 95 Al 4 Mn 0.25 (extruded)	33
Mg 91 Al 9 (cast)	44
S.A.E. 1050 steel (rolled)[a]	58
S.A.E. 6130 steel (rolled)[a]	62

[a] Heat-treated

The reduction in fatigue limit due to a notch differs widely for different materials. Table 5. The effect of threads is less damaging than notches of the same dimensions. In the case of tie-rods the reduction in fatigue limit due to the threads is about half that due to a single vee notch.

The tests shown in Fig. 6A were made on ½x0.035 and 1x0.065-in. chrome-molybdenum steel tubing. The outside

diameters of all tubes were reduced in the middle and the surface polished. One lot for the 900 and 650 deg. draw was also reamed on the inside, large circles on Fig. 6A. The fatigue curves for the tubes drawn at 650 deg. F. are shown in Fig. 6B. The general shape of the fatigue curve is similar to that for solid specimens. The ratio of F. L. to tensile strength is lower probably due to defects on the interior surfaces, as Gough[2] reports that hollow polished specimens give practically the same ratio as solid specimens. Tension and torsion tests failed to indicate the weakening effect of the scratches in these tubes. The presence of these defects is less serious in the case of statically loaded members of a truss than in a vibrating member such as engine support or tail surface attachments. These results further indicate that it is not desirable to use a drawing temperature much below 1,000 deg. F. for such parts. However, it has been established by a large amount of service data that drawing temperatures as low as 650 deg. F. are satisfactory for axles and certain designs of tail skids.

Effect of corrosion

Corrosion of metal causes pits and seams in the surface and with some metals formation of microscopic cracks between the grains. Unless the corrosion is well advanced, there is only slight reduction in tensile strength but a large percentage decrease in elongation and fatigue limit may accompany moderate corrosion. Corrosion is accelerated if the metal is under static or cyclic stress. A series of investigations by McAdam[9] indicate that when most metals are subjected to the continuous action of salt water or fresh water during a rotating beam fatigue test, a new limit is established which is lower than the normal fatigue limit in air. This was designated the corrosion-fatigue limit. Copper is one exception.

In the case of steel the corrosion-fatigue limit is independent of previous heat-treatment or cold work and does not exceed 25,000 lb. per sq.in. except for the corrosion-resistant types. Salt water is more severe than fresh water in the case of steel, whereas, for nickel, monel metal and duralumin, there was little difference between the action of the two media. Electroplating steel with cadmium (thickness of 0.0002 in.) raises the corrosion-fatigue about 100 per cent[15]. Zinc plating (thickness of 0.0011 in.) without previous pickling gave complete protection against corrosion fatigue in fresh water in one series of tests[9]. Desch[10] found the normal fatigue limit was lowered by nickel, copper and lead plating, 38, 11 and 3 per cent, respectively.

Corrosion-fatigue limits of the 18 per cent chromium, 8 per cent nickel steel are much higher than those for ordinary steels. Prior corrosion before the fatigue test for a period of 75 days by alternate wetting in a 20 per cent salt (NaCl) solution and drying in air gave no reduction in fatigue limit for this steel.

Rawdon[11] investigated the effect of applying static and cyclic stresses of predetermed value to duralumin and Alclad sheets and exposing them to corrosion by the wet and dry method of immersion at 15-min. intervals in a sodium chloride-hydrogen peroxide solution. The results indicate that stress increases the susceptibility to corrosive attack. If the surface is protected by pure aluminum (Alclad) the life of the material is greatly increased, thus indicating that unless there is a chemical attack at the surface the acceleration of corrosion by the imposed stresses is small. An examination of parts which have been removed on account of corrosion would indicate that chemical change is the predominating factor since fittings are corroded as badly in the unstressed as the stressed portions.

Actual conditions which would develop a corrosion-fatigue limit are not met in the operation of aircraft. Some acceleration due to imposed stresses may occur in the case of tie rods or vibrating struts.

The aeronautical engineer must consider the damage due to chemical breakdown of the material under alternate wetting and drying. Experience indicates that the electro-potential between two dissimilar metals is a more critical condition in accelerating corrosion than the static or cyclic stresses.

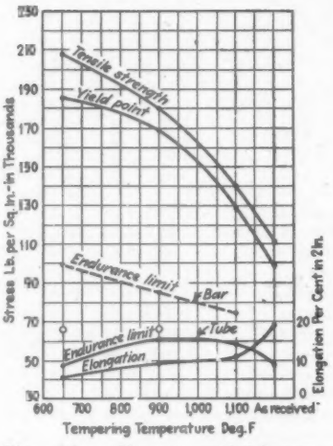

Fig. 6A: Chrome molybdenum steel tubing

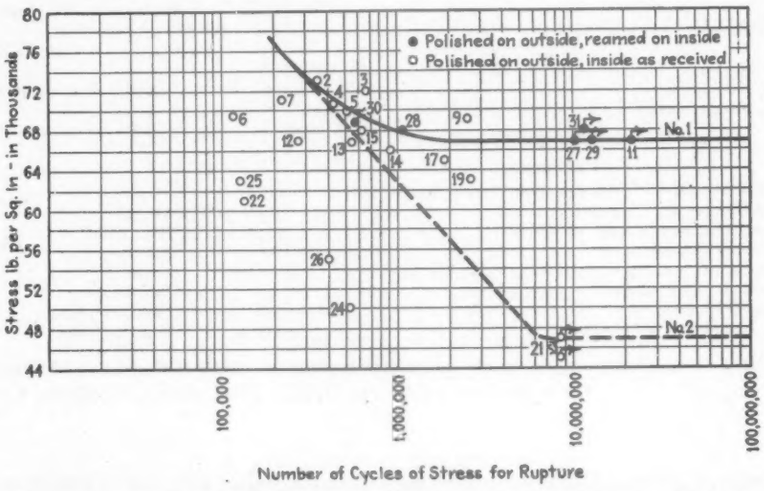
Polished on outside, reamed on inside
Polished on outside, inside as received
No. 1
No. 2
Stress lb. per Sq. in. - in Thousands
Number of Cycles of Stress for Rupture

Fig. 6B: Chrome molybdenum steel tubing, ¾ in. OD by 0.035. Carbon 0.29, manganese 0.53, chromium 0.87, molybdenum 0.30. Heat 1,625 deg. F. QO draw 650 deg. F. Tensile strength, 208,300 lb. per sq.in. Elongation in 2 in., 6.5 per cent.

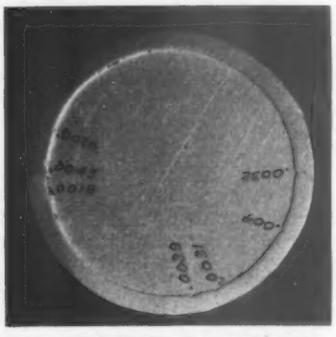

Fig. 6C: Depth of grooves, inside, in chrome molybdenum steel tubing used for fatigue tests

Endurance of aircraft metals

The chemical composition, heat treatment, tensile and fatigue properties of metals commonly used for airplane and engine construction are given in Table 6. All tests were made on polished specimens. In the case of the tests at Wright Field, the specimens were coated with lanoline to prevent corrosion.

The fatigue limits for aluminum and magnesium alloys are not so determinate as for other metals. In Fig. 7A are plotted the results of tests on specimens cut from several propeller blades.

The general scheme for selecting the specimens is shown on the blade which has been laid out for cutting up. The aluminum alloy blades are hammer forgings and conform to the average analysis and physical properties indicated. The tensile results are very uniform and do not show the effect of inclusions and non-homogeneous structure. The blades were notched and broken at several stations in order to make a visual examination of the structure. There is a marked difference in the appearance of the forgings (Fig. 8A). Most of the propellers of recent manufacture have the structure shown in Fig. 8B. The presence of inclusions or foreign particles in steel produces scatter in the individual results[3, 4]. The same effect is apparent in aluminum alloys, but is aggravated by the larger size and number of voids or seams. The wide scatter of the points gives a band rather than a single curve. Any individual forging will have one or more points in the vicinity of the boundaries of the band, but the location of the majority of points will depend upon the material in the forging. If it corresponds with Fig. 8A, the point will lie in the lower part of the band and with Fig. 8B, in the upper part. Transverse specimens give lower fatigue values than longitudinal specimens for the same stress. The fatigue values for the hub are definitely lower than for the blade section, but the variation in the values due to the different stages of reduction along the blade has only a slight effect which is largely masked by the scatter of individual results.

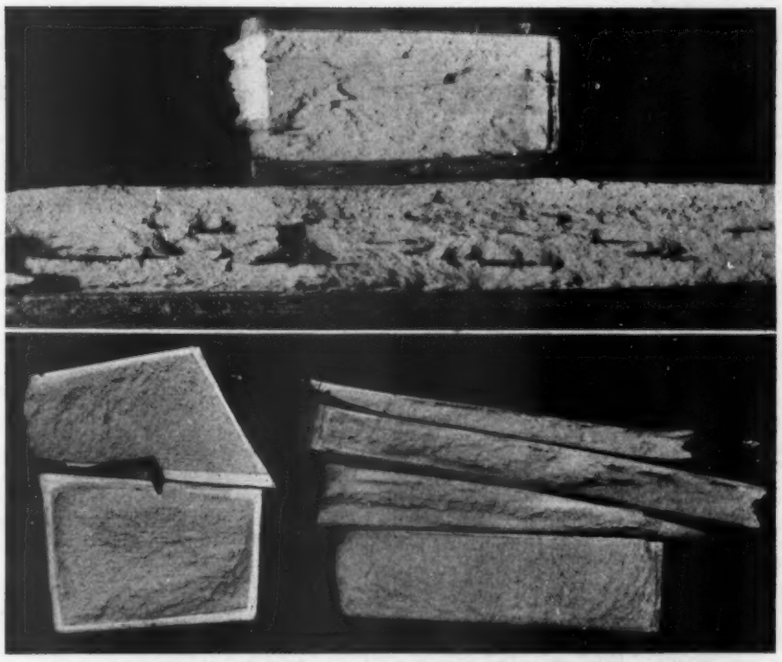

Fig. 8A (top) and Fig. 8B (below)

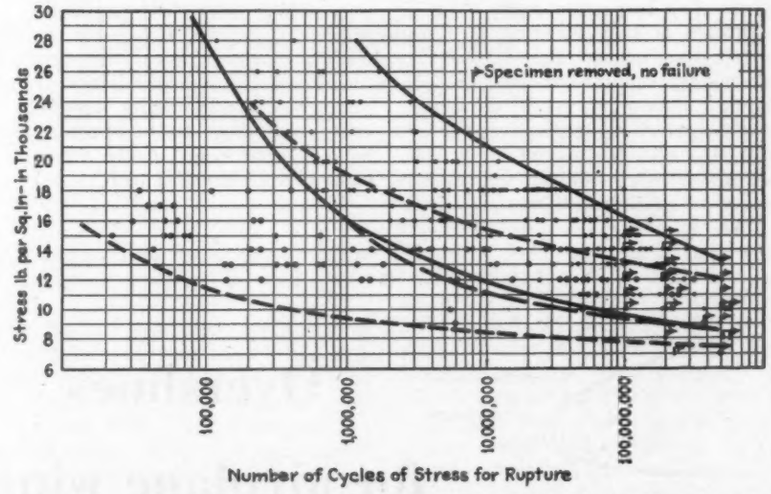

Fig. 7A: Solid lines, aluminum alloy (Cu. 4-5, Mn. 0.50-1.0, Si. 0.50-1.25, Al. diff.); broken lines, magnesium alloy (Al. 3.0-4.0, Mn. 0.30, Mg. diff.); long dash line is the lower limit for rolled blade

	Aluminum Alloy	Magnesium Alloy
Tensile strength, p.s.i.	61,000	34,000
Propeller limit, p.s.i.	28,000	6,000
Elongation 2 in. (per cent)	16	10
Reduction area (per cent)	20	15

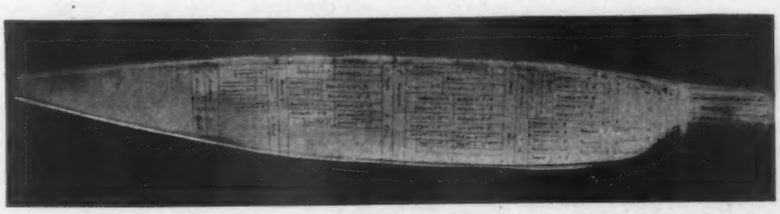

Fig. 7B

The lower boundary line represents the most conservative values for propeller design. A higher value may be justified on the basis of the gradual improvement of material which is indicated by tests on recent forgings, and the effect of size. A void or segregated area will occupy a larger percentage of the cross-section of a small test specimen than a large forging, and thus the injurious effect will be less.

H. F. Moore[21] found that when a specimen 1 in. in diameter was used a fatigue crack in axle steel required a longer period to propagate across the section than in the case of a smaller specimen, and it was possible to discover such cracks before complete failure.

In the case of the magnesium alloy, the lower part of the band was obtained on a large forged blade of early manufacture, the portion above the long dash line on a more recent blade which was rolled from an extruded billet. The improvement in the homogeneity of the material and the increase in fatigue limit was very noticeable.

Causes of fatigue failures

Fatigue failures in aircraft parts may be ascribed to the following causes: (*a*) Improper selection of material and maximum allowable stress. (*b*) Concentration of stress due to a restraint in a vibrating member. (*c*) Concentration of stress due to surface irregularities. (*d*) Corrosion.

The improper selection of material is

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seldom a cause of fatigue failure. Engineers generally study succesful designs and adopt materials which have proved satisfactory under similar conditions of service. The use of medium carbon steel for connecting rods, drive shafts and engine bolts has caused a few fatigue failures and replacement parts of heat-treated alloy steel have given satisfactory service. Failures in gasoline tanks and cowling have occurred due to the selection of material so thin that vibrations have started cracks at the rivet or bolt holes on account of lack of rigidity in the design.

The fatigue value, however, is not the sole criterion for judging material as the conditions of service are seldom so ideal as in a laboratory test. Sudden changes in stress and momentary application of high stresses require a toughness which is indicated better by the elongation and reduction of area in a tensile test and the resistance to impact. This has been demonstrated many times by the failure of engine drive shafts, connecting rod bolts, supercharger impeller shafts and similar parts which had a high tensile strength, hardness and fatigue limit but low ductility and resistance to impact. The engineer must be sure that the stresses do not exceed the fatigue limit and that an unexpectedly high stress can be absorbed by some yielding within the material without starting a crack.

The fatigue limit is a definite property of a material. It has not always been taken into consideration, however. The failure of Oleo springs is a good example. Several springs have been designed on the basis of proportional limit. The spring was considered safe if there was no permanent set after it had been closed solid and released, although the maximum stress might be equal to 75 per cent of the tensile strength. Oleo springs are subjected to repeated application of load and the fatigue limit must be considered. If the spring has a Brinell hardness of 420, the fatigue limit in shear for a range varying from 0 or a small plus load to a maximum plus load is about 50 per cent of the tensile strength. If the stresses exceed this value, the spring will eventually break.

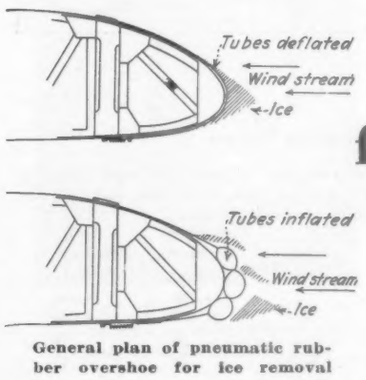
The concentration of stress due to end fixity in a long vibrating member such as a tie-rod in which the two terminals are out of line so that an initial bending moment is induced in the threaded portion or a strut in which the stresses are not tapered off by a gradual reduction in cross-section at the end, has caused a few fatigue failures in new designs.

The most prolific causes of breakdown in fatigue are surface irregularities. Failure does not result in all cases, but they are potential sources of failure.

One of the following can be discovered in practically any airplane or engine by close inspection: (*a*) Inadequate fillets. (*b*) File marks on finished parts at sections where the stresses are high. (*c*) Coarse machine tool marks. (*d*) Undercutting adjacent to bolt heads or flanges. (*e*) Inspection stamps cutting the surface at high stressed sections.

Corrosion reduces the fatigue resistance very rapidly but with the possible exception of very thin duralumin, corrosion which is serious is always visible and can be prevented by adequate protection. Failures due to corrosion have generally occurred on very thin members, such as, aluminum alloy fittings on tail surfaces, trailing edges of wings and parts where salt water is held in contact with the structure. The points of attachment of ribs, trailing edges, floats and hull plates are the points of greatest attack. The formation of rust on a steel surface underneath the organic coating, unless accompanied by pitting, has very little weakening effect in the case of a statically loaded structure, such as a fuselage, or landing gear. It is more serious at the end of an interplane strut or other members which are subject to greater amplitudes of vibration.

There is nothing mysterious about fatigue failures. With careful design and proper care in manufacture and inspection, fatigue failure can be eliminated. Since fatigue is accelerated by seemingly minor details which are often overlooked, it is highly desirable that every engineer and inspector should have a knowledge of the fundamental causes of fatigue failures.



General plan of pneumatic rubber overshoe for ice removal

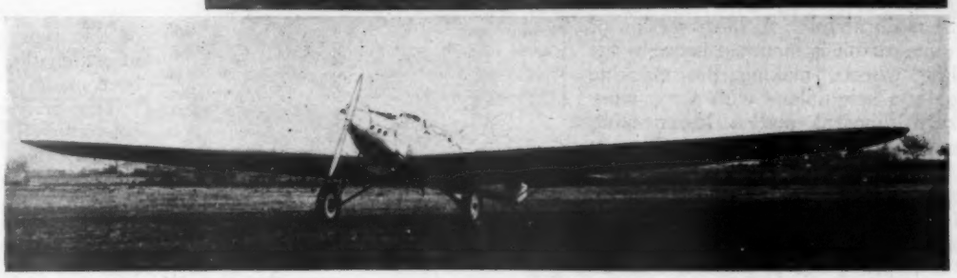
Overshoes for airplane wings

Mr. R. F. Geer of Cornell University in discussing the ice formation hazard to airplanes in flight at the recent meeting of the Aeronautical Section of the American Society of Mechanical Engineers at Baltimore, described the wing overshoes developed by him eighteen months ago, and recently under test by National Air Transport. The sketch shows how the deflated rubber shoe is stretched around the leading edge of a wing. If ice develops, as indicated by the shaded portion in the upper figure, air from a small compressor or storage bottle is introduced into the tubes, inflating them as shown below, breaking up the ice and allowing the solid pieces to be blown clear of the wing by the wind. The rubber surfaces are impregnated chemically with a substance which reduces the adherence of the ice.

Flying Equipment

ARROW SPORT BIPLANE

FOR sport and training purposes the Arrow Aircraft & Motors Corporation of Lincoln, Neb., has announced a new side-by-side two-seater designated as the Arrow Sport 85. The machine is a single bay staggered biplane, built on conventional lines. Upper and lower wings are tapered, with the lower only given a slight dihedral angle. Adjustable struts are provided for adjusting stagger at the center section.



Top: The Brown sesquiplane. Above: The Dewoitine 33. The Arrow Sport 85

The landing gear has an unusually wide tread for a machine of this size. It is of the split axle type, incorporating both compression shock absorbers and semi-balloon tires. The power plant is a LeBlond 85-hp. radial air-cooled engine. Manufacturer's specification are:

Length overall	20 ft.
Height	7 ft. 9 in.
Span	25 ft. 10 in.
Wing area	183 sq.ft.
Gross weight	440 lb.
Weight empty	933 lb.
Power loading	16.9 lb. per hp.
Wing loading	7.9 lb. per sq.ft.

THE FRENCH DEWOITINE 33

ONE of the most interesting of the long-range airplanes which have been built recently in France to assault world's records for distance and endurance, is the Dewoitine 33, a low wing single-engined monoplane of all-metal construction. The latter is perhaps the most unusual feature for a machine of this character, and the quality of the engineering which entered into the design may be judged from the fact that an all-metal, full cantilever wing of 840 sq.ft. with an aspect ratio of 10 was produced with a weight slightly under 2.4 lb. per sq.ft. To add to the difficulties in this respect, the wing had to be made up in five sections to facilitate ground transportation. The main structural member of the wing is a single spar which takes all the bending stresses. The leading edge is designed to resist drag and torsional loads. Considerable saving in weight was accomplished by incorporating fuel tanks in the leading edge for the greater part of the span. Auxiliary gasoline tanks are fitted behind the single spar in certain portions of the wing. The trailing edges are made of duralumin tubular ribs. The ailerons are exceptionally long and narrow and are made up in several separate sections each of which is provided with two hinges.

The fuselage is of duralumin monocoque construction, exceptionally well streamlined and incorporating a cabin which is unusually roomy and comfortable for a machine built to attack long distance records. Large side and top windows afford a wide field of vision. Three seats are arranged in tandem in the cabin with bed and toilet accomodations in the rear. A safety feature which is often overlooked in record seeking planes is the provision for leaving the cabin by parachute in cases of emergency.

The landing gear is of a split axle type fitted with large landing wheel (4½ ft. in diameter) mounted on ball bearing hubs and equipped with brakes. A castring tail wheel is provided.

A 650-hp. Hispano direct driven engine was originally provided as a power plant, for which a geared engine of the same make and horsepower was later substituted with some improvement in performance. The general characteristics of the Dewoitine 33 are as follows:

Length overall	47.2 ft.
Height	15.9 ft.
Span	91.9 ft.
Wing area	840 sq.ft.
Gross weight	21,310 lb.
Weight empty	6,610 lb.
Wing loading	25.4 lb. per sq.ft.
Power loading	32.9 lb. per hp.

AN EXPERIMENTAL SESQUIPLANE

AN INTERESTING attempt to obtain high aerodynamic efficiency through the use of exceptionally large aspect ratio has been made recently at Lawrence, Kan., by Mr. Benjamin Brown. Designers seldom attempt to use aspect ratios over 8 for powered airplanes, and ratios over 20 are

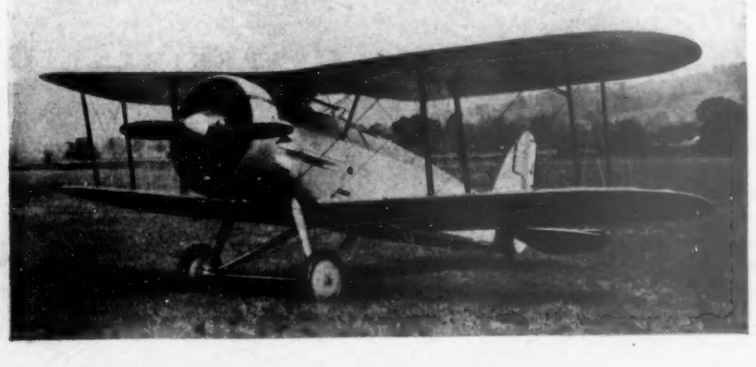
usually found only in soaring gliders of the lightest construction. In this case, however the span of the main wing is 50 ft. and the chord 2 ft. giving an aspect ratio of 25.

Although the aerodynamic advantages of high aspect ratios are well known, structural considerations usually limit the ratio to a relatively low figure. In Mr. Brown's monoplane the wing, which is of ClarkY-18 section, consists virtually of a single plywood box spar of such a shape that the addition of an aluminum leading edge and a fabric covered trailing edge (supported on cantilevered plywood ribs) gives the required airfoil shape. Each semi-span is braced at its midpoint by an auxiliary strut system running from the landing gear. The struts are in reality auxiliary wings of the same chord and section as the main airfoil. A short section of the same airfoil is mounted between the landing wheels, making the machine virtually a sesquiplane with a top wing of zero dihedral and a lower wing system with a dihedral of approximately 26½ deg. As originally built, ailerons were placed on the lower wings, but it was found that their action was unsatisfactory, and they were remounted on the upper wings in the conventional manner.

The design and the construction of the fuselage follow standard airplane practice, as all structural members are made of chrome molybdenum steel, and the whole is fabric covered. Air wheels are used in the landing gear without other shock absorbing devices. They are housed in generous farings set into the lower wing.

The machine is powered with a Hi-drive Cirrus engine. It is reported to have been successfully test flown. For storage purposes, the tips of the wing may be folded back to reduce the overall span to 34 ft. The general characteristics are as follows:

Length overall	22 ft. 10 in.
Height overall	8 ft. 7 in.
Span	50 ft.
Chord	2 ft.
Area, upper wing	100 sq.ft.
Area, lift struts	60 sq.ft.
Area, landing gear wing	8 sq.ft.
Gross weight	1,440 lb.
Weight empty	1,000 lb.
Wing loading	8.6 lb. per sq.ft.
Power loading	15.2 lb. per sq.ft.



SPARTAN E-4-301 MONOPLANE

THE Spartan Aircraft Company of Tulsa, Okla., has recently produced a new four-place cabin monoplane similar to the older model C-4-225, but powered with a 300-hp. Pratt & Whitney Wasp Junior engine, and carrying a number of changes in design which make for improved speed. A cowl of the NACA type is provided, and all exposed fittings are provided with generous streamlining. Full streamline enclosures have been fitted to the landing wheels. The manufacturer's specifications are:

Length overall	32 ft. 7 in.
Height	8 ft. 11 in.
Span	50 ft.
Wing area	299 sq.ft.
Gross weight	4,056 lb.
Weight empty	2,608 lb.
Wing loading	13.5 lb. per sq.ft.
Power loading	13.5 lb. per hp.

APPROVED TYPE CERTIFICATES

DURING the period July 11 to August 15 the Aeronautics Branch of the Department of Commerce issued the following Group I approved type certificates: 432, Douglas Dolphin 3 (two P & W Wasp Juniors 300 hp.); 435, Stinson Model W (Wasp Junior 300 hp.); 436, Curtiss-Wright Travel Air A6A (Wasp 420 hp.); 437, Kellett K2 Autogiro (Continental A70 165 hp.); 438 Kreider-Reisner KR-C7-A, (Cirrus Hi-drive 95 hp.); 439, Alexander Flyabout (Continental A-40 38 hp.); 440,Curtiss-Wright Kingbird D 3 (two Wright R975s 300 hp.); 441, Ford 4ATF (three Wright R975s 300 hp.); 442, Curtiss-Wright Travel Air A14D (Wright R760 240 hp.).

Engines: 74, Aeromarine AR3, 50 hp. at 2125 r.p.m.; 75, Jacobs L3, 55 hp. at 2125 r.p.m.

TWO BRITISH MILITARY PLANES

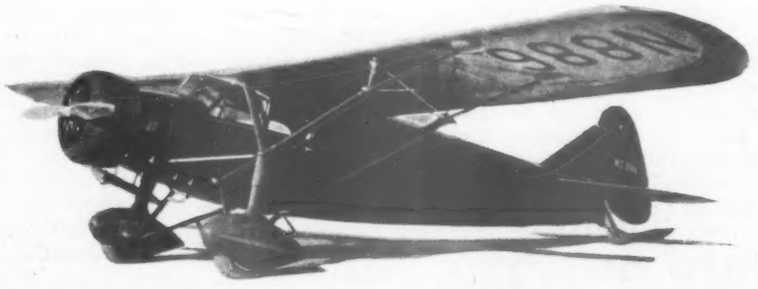
THE famous two-gun bad man of the old American frontier has a modern counterpart in the multi-gun fighting airplane with which practically all first rate powers of the world are now experimenting. One of the latest of this type is the new Gloster SS-19, of which the first delivery has recently been made to the Royal Air Force.

The SS-19 is a two-bay biplane of conventional appearance, designed as a high altitude fighter. It is constructed entirely of metal with the exception of the fabric covering. The first machine was fitted with a single Briscol Jupiter, radial air-cooled engine with Townend ring and rated at 480 hp. at an altitude of 9,000 ft.

The two-bay structure was selected on account of its greater rigidity to permit violent acrobatics and diving at very high speed. Relatively narrow ailerons of the Frise type are fitted.

The armament consists of two Vickers machine guns carried in grooves in the fuselage fired through the propeller by a synchronized gear. Four other machine guns of the Lewis type are mounted out on the wing well clear of the propeller slip stream. A rack for four 20-lb. bombs is mounted under the fuselage.

A new supercharged version of the Boulton & Paul Sidestrand twin-engined day bomber has also been produced for the Royal Air Force. In general it conforms to the previous model now in use by one R.A.F. bombing squadron, but it is fitted with the Bristol Jupiter S. F. engines which give a maximum output of 560 hp. each at 11,000 ft. Test pilots have reported that the new engine gives considerably better performance than the older model. Townsend rings are fitted.



Above: The Spartan E-4-301
Below: The Gloster SS-19

Aircraft at Work

Flying grocery store has successful career

ONE of the most effective airplane advertising campaigns has been staged by Reid, Murdock & Company, Chicago, with its "flying grocery store." The plane—a Ford transport from which seats had been removed to provide room for display of the company's Monarch brand products—was operated for more than two years, contacting points in almost every state and in Canada and Mexico. It was definitely a part of the company's advertising campaign, all expenses being charged to that department, and is considered by the company an eminently successful medium. It was withdrawn from service last spring largely because the company considered the more than 450 airports visited included practically all those desirable to contact.

Routing of the plane purposely eliminated long jumps, the daily time in the air rarely exceeding an hour and a half. As a rule the plane party stayed over only one night in a given community, except in the case of week-ends. The plane was sent on some of the organized air tours, also, such as the 1930 National and 1931 Florida tours. Expenses of plane and personnel averaged between $75 and $100 per day, not including newspaper advertising, publicity material, and allied items.

A visit to a community was always preceded by local newspaper advertising and the cooperation of the local grocer representing the Independence Grocers. The plane was called the Independence, by the way, in honor of this group. Attendences at airports often ranged between 15,000 and 30,000, and in many instances airport attendance records were broken with the company's plane the only attraction. The flying grocery angle aided tremendously in securing the generous allotment of newspaper space, which in the aggregate exceeded the amount of space bought for advertising.

Arrangement of the foods on the racks in the style of a grocery proved an extremely forceful method of attracting attention to the brands produced. The pleasant relations established with the public at many points accounted for persons at later stops greeting the crew as old friends whether they had seen them before at Oklahoma City, Huron, or Burlington, Vt During the period of service there was no accident of any kind and the company claims that there was no landing sufficiently rough to dislodge the display jars from the racks. The pilot was V. N. Johns.

The interior arrangement of "the flying grocery store"

Plane makes good as contact medium

THE H. C. Noll Company, Omaha, distributor of radios, mechanical refrigerators, batteries and radio tubes, is thoroughly convinced of the value of a company-owned plane for general transportation, for sales promotion and contact, and for general publicity. H. C. Noll, president, declares that the concern will never be without the use of a plane in its business.

In sales promotion the first man on the ground, if he is the proper type of salesman, has the first opportunity to close a contract. The Noll plane has enabled representatives to contact a prospect with minimum loss of time, close a contract, and be back home before competition has gotten well started. The company is convinced that with the plane more publicity has been secured than could possibly have been attained by a similar concern by any other method.

The Noll plane, a Travel Air cabin machine, has been flown 167 hours and has covered 18,640 miles. Gasoline and oil expenses have totalled $541.60, insurance $270, hangar rentals $225, and servicing—such as checking valves—$54.20. Transportation of representatives by conventional means between the points covered by the plane would have cost $1,267.40 more than was spent getting them about by plane, and an impressive total of 56 days, 7 hours, was saved for additional time at the home office. Since Mr. Noll flies the plane, the expense of a professional pilot is eliminated.

2,000 hours of difficult assignments

THREE seasons at forest patrol work, a wide variety of miscellaneous activity requiring much hard flying, and still going strong, is the record of a Stearman Model C3B bought by N. B. Mamer of Mamer Air Transport in 1928. It has been flown a total of more than 2,000 hours. In 1928 it was flown 100 hours with a revenue return of $117 per hour. In 1929 it earned $50 on forest patrol work alone and in 1930 $45 per hour. It will be flown 300 to 400 hours this season (June-October) on forest patrol.

When not on patrol duty the plane is given the usual varied assignments that crop up in general commercial flying. It has been used much at night, it has been employed in high altitude photographic work, and has figured in many emergency errands. For a brief period last August it was removed from the patrol duty to participate in the Seattle-Chicago derby, winning second place in a fast field.

Last November it figured in an interesting experience which might have resulted unfavorably for its owners. The machine was flown to central Idaho where Mamer and a friend spent seven days hunting. The machine had been staked out and on their return it was found to be coated thickly with ice. Two days were spent removing the ice at a working temperature 10 deg. below zero. Another day was required to drain and heat the oil and heat the engine, using an improvised tent over the nose. They finally took off and landed at Spokane without sufficient fuel to taxi to the hangar. The gasoline consumed in getting the engine in running condition accounted for this extremely precarious margin.

Airport Management

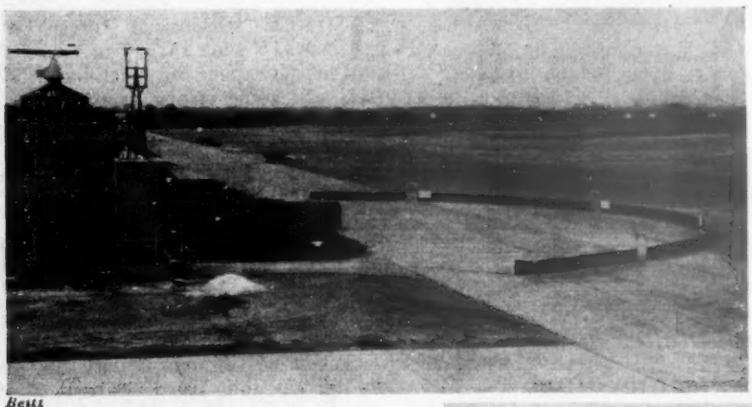
Gate system facilitates air passenger handling

LOADING passengers speedily and without confusion when two or more airliners are due to depart from a common waiting station at about the same time is being attained at the Cleveland Municipal Airport by a gate system closely resembling that familiar in railroad practice. The gates are in a semi-circular fence of piping and canvas, each plane being assigned to a certain gate.

Since as many as four planes may be loaded simultaneously with the equipment now in use, this system constitutes a promising method of speeding up air transport handling at the busier ports in the face of an increasing traffic volume.

This also indirectly contributes to the solution of the general problem of traffic control, the subject of much contemporary study by the Aeronautics Branch and the Aeronautical Chamber of Commerce.

The installation below is in front of the municipal administration building and waiting room, used by National Air Transport in its local and transcontinental operations and by other lines operating from the Cleveland port.



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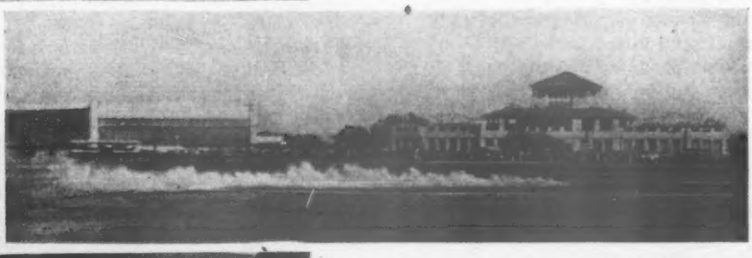


Loading apron in front of Cleveland administration building. Right: Smudge pot in operation at United Airport

Vialet

Interior of the reinforced concrete hangar in Rio de Janeiro

A hangar of reinforced concrete

BECAUSE reinforced concrete is one of the cheapest and most suitable construction materials in Brazil, it is widely used for industrial buildings. Recently a 440x160-ft. hangar of this material was completed at the only real Rio de Janeiro airport—Campo dos Affonsos, a military post. This hangar is of reinforced concrete throughout even to the two immense 117x26-ft. sliding doors which provide a clear opening of 234 ft.

Each door moves outward to the side over outriggers on two wheels. One of each pair of wheels is powered by a 2-hp. electric motor, placed above it. The doors can be opened or closed in 60 sec. They were cast on the ground and raised first to a horizontal position halfway between the top and bottom of the opening; they were then swung to the vertical position and adjusted on the tracks.

The central part of the hangar is carried by two reinforced concrete arches with a free span of 305 ft. In Brazil, where there is no snow load and little need for heating, there are much larger spans in reinforced concrete than in northern countries. Shop and office space is provided along the sides of the building and at the rear.

The architectural and technical design were executed by Emilio H. Baumgart, consulting engineer, in Rio de Janeiro.

Avoiding monotony for airport visitors

THE visitors to an airport go there to see and hear about airplanes, but they often are given an overdose. In the course of two or three hours of

constant flying and constant chatter through a loudspeaker about the wonders of aviation and the desirability of taking a hop, some of them reach the point where they would find any change a relief. Their interest in aviation would really be heightened by being given a rest. At Curtiss-Reynolds field in Chicago, where the grandstand balcony and roof offer particularly pleasant points of vantage from which to watch the flying, a loudspeaker is periodically tuned in on an intelligent and well-edited sports' talk. Personalities about pilots and descriptions of planes are interspersed very effectively with personalities about the members of the White Sox and Cubs, and descriptions of the University of Illinois' plans for the coming football season.

Smoke pots and runway surfacing

THE efficiency of the smoke pot wind indicator developed at United Airport, Burbank, has been increased by reducing the draft and by substituting stove oil for crude. With these slight changes the smoke pot continues to be the chief wind direction indicator at the port in daylight hours, and remains in the conspicuous location at the center of the runway system. A conventional lighted T mounted on a 30-ft. pole is used at night.

Servicing practices have been developed by experience with the device. It is filled with 20 gal. at 6 each morning, enough fuel to keep it going until about 7 at night. Fuel consumption is at the rate of about 5 qt. per hour. The fuel is ignited from a burning square of cloth oil-soaked and attached to the end of a long wire.

Soot is knocked loose from the smoke stack about every two hours to insure proper working. The under part of the cover over the pot itself, which rests on the bottom of the concrete pit, is not too thoroughly cleaned of soot and carbon as these act as a wick when relighting at the close of the cleaning process. The heavy grating, which lies flush with the airport surface and through which the pot chimney projects about 2 in., is protected by burlap bags from oil dripping in fueling to avoid fire.

United has had trouble with the surface of its asphalt runways. A number of lumps or moulds have been appearing on the surface though the 3,000,000 sq.ft. of runways are only about a year old. Investigation revealed these were caused by the stubborn and tough greasewood weed, which had pushed itself up through the 14 in. of treated earth and asphaltic top.

Remedy consisted of digging out the weeds, in many cases going as deep as 14 in. to get at the roots. The holes thus caused were filled with refuse oil and the pavement given the periodical smoothing treatment with tractor roller, and combination scarifier and grader. The treatment was successful.

FAST FLYING AND AN AUTOBIOGRAPHY

SPEED, *by Frank Hawks; Brewer, Warren & Putnam; New York, 1931; 314 pages; $2.50.*

A RECENT questionnaire circulated among representative business and professional men and private individuals asked what specifications they would demand of a personal airplane, providing each were able to own one for his business and pleasure. Results were not a little astonishing; almost without exception the speed demanded was close to 60 m.p.h., never 120, 150 or higher.

This indicates in graphic fashion one thing—that the public has no conception of the value of speed as applied to the individual, nor of the airplane as a basically economic vehicle for time-saving. Speeding airplanes are acceptable, they seem to think, for mail and perishable goods, but for themselves probably speed is not important. Unhappily, speed is the only real asset which aviation has to offer the work of business—remove it, and airplanes are nothing more than playthings, a sport for those who can afford it. Air travel operators have plenty of selling to do yet, it seems, and the sooner they get busy the better.

Frank Hawks, the well-known air-speedemon, has hitched his (aerial) wagon to a lucky (Texaco) star. In his book, which is a combination autobiography and exposition of fast flying as applied to industry, or aviation's real place in business, we see how he floundered around from one job to another, from mechanic in Los Angeles to itinerant pilot in Mexico, from oil well tool dresser to ranchero, from Army instructor to barnstormer, with the next meal usually a problem, until finally he convinced ambitious and enthusiastic officials of the Texaco Company that they needed an aviation department. Then he became it. Since then everything has been smooth—or rather, fancy—flying.

The word "Texaco" is on the jacket and permeates the book. It is almost as ubiquitous as the Hawks smile, which certainly should be teamed with a toothpaste company. Early portraits of the famous aviator show the beginnings of the smile that, as the sense of humor developed by gipsy fliers about 1921 grew, was to become a toothsome grin. But, despite the present business connection, the smile certainly is not oily. It is frank.

As a youngster, Hawks was develop-

The spectators' gallery at Curtiss-Reynolds, Chicago, equipped with a loudspeaker system

TACOMA PUBLIC LIBRARY

ing his talent along histrionic lines, and Shakespeare was a strong favorite. Small parts in stock followed, until the family moved to California. Here another calling soon captured his attention when Christofferson came to town with his basketwork biplane. Posing as a local reporter, the boy actor wangled a ride and was learning flying within a few months, unknown to his family.

When the war came Hawks rose to a lieutenancy in the Air Service and fought the battle of Brooks Field, characterized by careful instructing and reckless personal flying on the part of the instructors, while the C. O. furnished the sound effects. In civil life once more the young aviator turned to barnstorming with Jennys and OX-5's, a precarious life at best. Thrilling Mexican natives was the next job, which lasted for several tumultuous years, punctuated by crack-ups, flying drunken officials and out-bluffing bandits on their ranch raids. When the bandits finally won, it was charged off to experience.

When the Texas Company finances became more settled, the newly created aviation department set out to demonstrate what it could do in a publicity program for aviation and the Texaco star. The towed glider trip across the country is as well known as the record-breaking non-stop Lockheed and "mystery ship" flights, now slightly eclipsed in news values by the speed hops between European capitals.

The book itself is timely because of Captain Hawks' activities and the emphasis on speed given in daily press accounts of world-girdling flights, but it is far more necessary to aviation for its message in selling speed in aviation to the public at large. As it will be read largely by the younger generation, such missionary work will be productive of lasting results and gratifying rewards. It is probable that Frank Hawks has contributed as much as any one man toward selling flying's greatest asset, and this book is the summation of his attempts to break records and his adequate reasons for so doing. As such it needs no further commendation.—HORACE S. MAZET.

AIRSHIPS AND BALLOONS

THE STORY OF THE AIRSHIP, *by Hugh Allen; The Goodyear Tire & Rubber Company, Akron, Ohio; 71 pages.*

THIS volume is the sixth edition of a work published annually by the Goodyear Tire & Rubber Company since 1925 and is described on the title page as "a convenient reference book for students, writers, and others interested" in the subject of airships and balloons. It is literally crammed full of interesting facts, figures and photographs covering lighter-than-air developments in general, and the activities of the Goodyear-Zeppelin Corporation in particular. Past history and present status are thoroughly covered, together with a certain amount of prophesying with regard to military and commercial activities of the future. Numerous photographs and sketches show the construction of the ZRS-4, and the new airship dock at Akron, Ohio. Discussion of methods of mooring airships, production and purification of helium, the training of airship personnel, etc. occupy prominent places.—S. PAUL JOHNSTON.

THREE INTERNATIONAL MEETINGS

RAPPORT DE LA PRÉMIER CONGRÉS INTERNATIONALE DE LA SÉCURITÉ AÉRIENNE; *First two volumes; Comité de Propagande Aeronautique, Paris; 316 and 310 pages.*

FIFTH INTERNATIONAL CONGRESS OF AERIAL NAVIGATION; *convened at The Hague in September, 1930; Two volumes; Martinus Nijhoff, The Hague; 1,740 pages (total); $15.*

PROCEEDINGS OF THE WORLD ENGINEERING CONGRESS; *held in Tokyo in 1929; Fifth volume (Precision Machines and Aeronautics); Kogakkai, Tokyo; 632 pages.*

WHILE the three meetings of which the proceedings are listed here have enough similarity to justify a common treatment, they differ widely in purpose and background. The meeting at Tokyo, like earlier world power conferences in Europe, was literally a world-wide affair, with almost 300 organizations participating and about 700 foreign members and 3,000 Japanese attending. Its proceedings run the whole gamut of engineering science and fill 39 volumes, of which aeronautics claims a relatively small part of the one here reviewed and a still smaller part of another. The session at The Hague was one of the series of international air conferences that have been held approximately once every two years since the War, all of them in European capitals except the Washington session in 1928, which was a special occasion to commemorate a historical event. The discussions at The Hague included everything pertaining to aeronautics. Those in Paris were much narrower in scope. As its name implied, the Paris meeting concerned itself only with safety in aviation and with receiving and discussing papers bearing upon the increase of safety.

The reports of the congress on aerial safety are unusual in another respect. It is the custom to receive papers for such meetings in any language and to print them as received, with the bound proceedings an indiscriminate mixture of anything from two to ten tongues. At the Paris meeting everything was translated into French and so published, and indeed about 90 per cent of the papers were from French sources, with the rest a mixture of many national origins. The only American contribution was from P. G. Johnson of United Airlines, entitled "The Point of View of the Operator."

Such a book is always variable in the quality of its content, and always written from many different points of view. The reports of the Safety Congress are well made up, and the papers submitted are well classified under eleven general headings, of which "Materials" and "The Power Plant Group" proved the most popular. It is most unlikely that any reader, however catholic his interest, will care to go through more than 10 per cent of the individual papers unless his aims are purely bibliographic. Each would select for himself the particular themes that interested him.

Radio navigation is well covered in a number of papers, meteorology not so well. The sections on airplane and power plant include a few eminent contributions, but on the whole they are inclined either to promotional literature for inventions or to sketchy summaries of existing knowledge. Most of the papers in all sections suffered from undue condensation, four or five pages being the limit allowed to each one. Material on classification and study of accidents and accident statistics, with papers by four or five authors of as many different nationalities, is distinctly disappointing, and suggests that, in spite of the great interest taken in the subject and in spite of the assistance of a specialized Service de la Securité Aérienne, and of similar agencies in other countries, the United States has a good lead over the rest of the world in these matters. Studies of the work of the European marine classification societies in the aeronautical field, by M. De L'Escaille and others, will repay careful reading.

The reports of the conference at The Hague are much more satisfactory, although there too, as in all international meetings, a large amount of pure publicity material designed to exploit national or personal ego crept into the proceedings. The American part is almost as scant as at Paris, the United States getting in three papers out of 122 and all three coming from the Department of Commerce. One of them is a very exhaustive discussion of American airways practice by Secretary Young, with many drawings and photographs of lighting equipment and other elements of ground organization, perhaps the best general review of our work that has ever been brought together under a single title.

At The Hague, as at Paris, the design papers were highly varied in subject matter and also in quality. Most of them were extremely theoretical, but

there were exceptions, especially among the contributions from the British sources. The papers by F. M. Green of Armstrong Siddeley on steel aircraft construction, and by R. J. Mitchell of Supermarine on the use of model tank results in designing floats and hulls, for example, require no mathematical talents for their appreciation, and can be read with profit by every designer. A large proportion of the technical papers are of Russian authorship, and that group is rather below the general average in quality and practical utility, although it includes a very interesting study of the application of propeller theory to design by W. E. Wetchinkine.

The medical section was very well patronized, and contains several contributions no doubt of the greatest interest to doctors, and the legal section gave special attention to the limitation of liability in international air transport and to the application of the laws of neutrality in aerial war. By far the most interesting of the five divisions, however, is that on commercial aviation, which includes among its eighteen papers both discussions of airway layout and management, such as Secretary Young's, and analyses of the economic problem. Most brilliantly effective is a contribution from Albert Plesman, presiding genius of K.L.M., on the economic aspects of air transport. It should be read by every transport operator. Of somewhat more specialized nature, but nevertheless of the greatest interest, are papers by Martin Wronsky, director of Lufthansa, on relations between air transport and other forms of transport, and Capt. Norman MacMillan's presentation of the point of view of the pilot as a professional man. Captain MacMillan is especially hostile to giving a flight surgeon unlimited and arbitrary authority over a pilot of long and unblemished record, and his paper drew forth discussion from Mr. Plesman no less interesting than the paper itself. The 50 pages devoted to those three subjects alone are worth the price of the book.

Last come the Tokyo proceedings, fortunately printed with the exception of two papers in English instead of Japanese. Although the language is English, the authorship is Japanese in half of the 22 cases. The Japanese papers are inclined to be over-theoretical, as are those of Russian authorship, integration sometimes being used where simple arithmetic based on a graphical presentation would not only suffice but be preferable. The Tokyo Congress, like that at The Hague, contains an excellent treatment of British steel construction practice, the author in this case being H. M. Wylie, and a discussion of British experience with flying boats. It is more than a little startling to find a British author, H. Davies, writing "The Case for the Monoplane," British opinion having been notoriously hostile to that type. Among the particularly distinguished contributors, whose names guarantee the quality of their papers, are Dr. Prandtl, who writes on turbulence, Dr. Lachmann, who developed the slotted wing independently in Germany at about the same time that the Handley Page organization was developing it in England, and A. H. R. Fedden, Bristol engine designer. The state of aerial research in Japan is competently, although briefly, summarized by Baron C. Shiba, director of the Aeronautic Research Institute at Tokyo. The only American contribution is a general review of the unsolved or partially unsolved problems of the airplane designer, and bears the signature of the writer of this review. Another American author, C. M. Keys of Curtiss-Wright and North American Aviation, submitted a paper on "The Business End of Aviation," which will appear along with two British offerings on air transport in Volume 18 of the proceedings.—EDWARD P. WARNER.

SEVENTEEN PAPERS ON MATERIALS

SYMPOSIUM ON AIRCRAFT MATERIALS (1930); *American Society for Testing Materials; 189 pages; $2.00.*

IT IS generally accepted by the aeronautical fraternity that except for any change in fundamental aerodynamic design principles, detail improvement in aircraft and aircraft engine design will be as much a matter of progress in the technique of material application and control as it will be in that of design form and tolerance. Therefore, this authoritative little volume, reflecting as it does the experiences and opinions of the leading experts on aircraft materials is distinctly worthwhile for every engineer and designer, and is particularly opportune.

The subject matter of the seventeen papers comprising the major portion of the volume includes: ferrous metals; light alloys; highly alloyed steels; wood; textiles; corrosion prevention methods; finishes; stampings, forgings and castings; engine materials; engine parts failures; specifications and materials control; testing; metal joints; welding; X-ray testing; photo-elastic studies and heat treatment.

The significance of proper material selection is aptly emphasized by Moore on "Aircraft Engines" when he says, "A common method of selecting steels for certain parts has been to adopt the same steel as used in a similar part in some other engine. The defect in this system is that no two engines are exactly alike and a steel that proves successful in one engine may not be successful in another of apparently similar design, because the service conditions to which the part is subjected are not nearly as alike as is commonly supposed."

The importance of production methods is clearly brought out by Runde in "Stampings, Forgings and Castings" when he states, "In the transition period in design from experimental to production quotas and with uncertain markets, a designer has a perplexing problem to face in his choice of production methods. So far he has usually constructed the first machine according to the quickest and most economical means, leaving production refinements of design and manufacture until such time as a production demand was created by demonstrated merit. The situation results that the experimental plane must not be prohibitive in expense and yet those types of construction which will be cheaper in quantity production must be kept in mind so that increased production may be possible without complete redesign. It is unfortunate in this respect that progress has been so rapid that no model remains in existence long enough to permit proper study and refinement of design and production of its individual fittings. The result is a continual compromise."

The symposium form of presentation is particularly well suited to this subject. Whatever the authors of the initial seventeen papers may lack in specific details concerning the application of their specialized knowledge, is clearly brought out in the 43 pages of discussion. In fact, the answered questions and additional information supplied in the discussion just about round this out as the most complete and authentic book produced yet on strictly aeronautical materials. There is one regret, and that is that the illustrations, while perhaps reasonable in quantity for a volume of this size, are so grouped that two-thirds of the papers are without illustration.—JOHN F. HARDECKER.

LIGHTER-THAN-AIR HISTORY

CRUISERS OF THE AIR, *by J. C. Hylander; Macmillan & Company; 306 pages; $2.50.*

MORE than 100 years before the Wright brothers took off from Kitty Hawk, two brothers, Frenchmen, had built the first lighter-than-air craft, and between the Montgolfiers of 1783 and Count Zeppelin in the present century, many long-forgotten inventors had sought to utilize the lifting force of hydrogen gas by attaching engines and empennage to curiously shaped containers.

The lighter-than-air ship was to wait for light weight internal ignition engines, for duralumin, for stress analyses, for a better knowledge of meteorology.

In "Cruisers of the Air," Mr. Hylander has gone back into the records of these pioneering efforts in lighter-than-air and has written an interesting book on the progress of the

lesser known division of aeronautics, carrying that record through to the Graf Zeppelin and the U. S. S. Akron of today.

Since the bibliography of lighter-than-air is limited, especially on the non-technical side, the book should be useful to students and journalists. It grew out of the author's work with boys at the Roger Ascham School, is easy to read, and should find place in the list of aeronautical text books.—HUGH ALLEN [*Goodyear-Zeppelin Corporation*].

Old pullers succeed with new wrinkles

LANDING to a mark, bomb dropping and altitude climbs—the old standbys—still may be counted upon to attract crowds to the airport when they are carried out under certain circumstances. This has been proven at Bowles-Agawam Airport, Springfield, Mass., where Harry J. Hermann, manager of the field and of the flying service operating thereon, has staged several successful informal competitions emphasizing the sportsman's angle.

The flying was done by the regular pilots, advanced students and individuals who regularly rent planes from the management. About 3,100 cars were counted at the field the first day the events were announced. The appearance of the private fliers added interest for the spectators because of their non-professional status and because many were competing for the first time.

Interest was enhanced by a guessing contest in which the spectators took part. One of the non-professional pilots flew his machine to a certain altitude directly over the field. The ten guessing nearest to its height were given free rides in one of the sight-seeing machines. The altitude attained in the first contest was 1,920 ft. Ten guessed within 20 ft. of it.

Merchants' coupons good for cut rate flights

A SCHEME for stimulating interest in joy-hop flights was recently tried with much success in Casper, Wyo. The Casper *Herald-Tribune* sponsored a double page advertising spread that appeared in one issue of the paper. This spread carried the individual advertisements of most of the merchants of the town, the feature of the spread and of all the individual ads being that every individual who purchased goods worth $1 or more from any of the stores advertising was entitled to a coupon which, together with 98 cents, entitled him to a ride in a single-engined Stinson operated by the Wyoming Air Service.

The results were profitable both for merchants advertising, and for the air service company, and incidentally for the newspaper as well. More than 600 people availed themselves of the offer on the one Sunday for which it was good. Similar ideas have been carried out successfully in several other Wyoming towns.

Factory and dealers cooperate in sales effort

A NOTEWORTHY example of close cooperation between all units of a manufacturer's sales organization is provided by the Buhl Aircraft Company in regard to its Bull Pup. Supplementing other forms of promotion, a communication was sent to a mailing list inviting comments on the general characteristics of the new machine. Expressions of interest in actually trying out one of them were forwarded to the company's distributors in accordance with the location of the prospect.

The distributor—in the case which came to hand it was Northeastern Air Service, Inc., at Bridgeport—sent out a form letter describing in further detail the claims of the model for serious attention in the field for which it was designed. In conclusion it was explained that the nearest dealer representing the distributor would be able to arrange a trial demonstration flight and the name was given.

Failure of a prospect to follow up the invitation within a reasonable period brought forth another form letter, giving examples of successful owner operation and similar sales material. A business reply envelope was enclosed for acceptance of the invitation or for any comment which was desired.

What Our Readers Say

Touring comforts

TO THE EDITOR:

"What's wrong with aviation?"

Here's one thing: Lack of comfort and convenience in open ships.

Suppose you are touring in your ship. You come to a field for the night. No place to put parachute under lock and key. Why not a space behind the pilot's cockpit? Label the door so space will not be used except when ship on ground, if afraid the center of gravity will be brought too far aft; or better, design for this load.

Particularly on tour, you should carry: Cockpit covers, engine cover, prop cover, rope to stake down ship, spare rags, extra maps, etc. The compartment behind the pilot's cockpit, in the turtleback should have a lock.

On all trips you should carry necessary engine tools, a small tool kit with safety wire, etc. These seldom necessary but wanted occasionally—and how! Why not a compartment under the passenger's seat up forward? This is about on center of gravity and just the place to put heavy stuff. Also, should be under lock and key.

Master key should fit all three compartments.

Then a good windshield that really shields from air and throws all water behind the pilot.

All of these facilities I have in my own open biplane, but I had to design the ship and have it made to order.

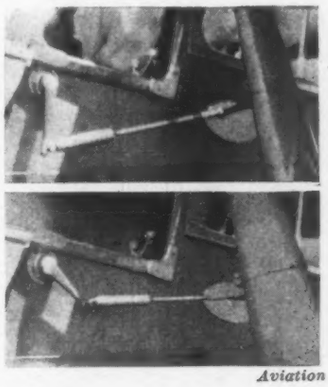
Your reasons for not including these, Messrs. Designers!

EARLE OVINGTON
Santa Barbara, Cal.

Design Novelties

A glider towing release

WITH the growing interest in the towing of gliders behind automobiles, numerous devices have been developed for releasing the towing rope from the towing car in cases of emergency. A simple and effective arrangement of this sort is now in use by the B. W. Flying Service at LeRoy, N. Y. An open wrought iron hook is pivoted in the end of a short tubular strut welded to an iron bracket, which in turn is attached to the right rear bumper



Aviation

Air brake on the Puss Moth. Top, normal flying position, and below, brake on

of the towing car. Normally the hook is restrained from opening by a stirrup-like latch. A small counterbalance holds the latch in the locked position. When in use, an eye in the end of the towing rope is slipped over the pivoted hook and the latch swung into position. In case it becomes necessary to release the glider, a pull on the rope attached to the latching stirrup allows the hook to swing open and the eye to pull free. A very light pressure on the tripping cable operates the device.

Air brake on the Puss Moth

AN INGENIOUS device is being used on the English DeHaviland Puss Moth for decreasing the forward speed in a glide by increasing the parasite drag of the plane. Broad streamlined struts running from the upper longeron to each landing wheel are arranged so that they can be turned 90 deg. around their longitudinal axes. For normal flying, the struts are held in a position with their major axes of cross section parallel to the wind. When it is desired to slow down the forward speed in a glide, however, they are twisted broadside to the wind. The over-all drag of the machine is materially increased, not only from the increased resistance of the struts, but also due to the increased interference between the struts and fuselage.

Aviation

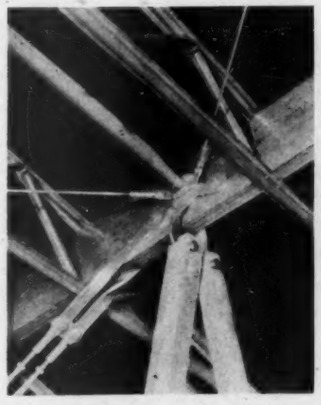
Release for glider towing

Strut attachment to an upper wing

A NUMBER of interesting constructional features are noted in the attachment of the outer bay struts to the upper wing panel of the new Consolidated Model 21-A Trainer, built by the Consolidated Aircraft Corporation. A relatively simple fitting cut out of steel plate, welded together, and formed by means of a few simple twists, takes care of the attachment of the struts, lift wires, and drag bracing to the rectangular laminated spruce bars.

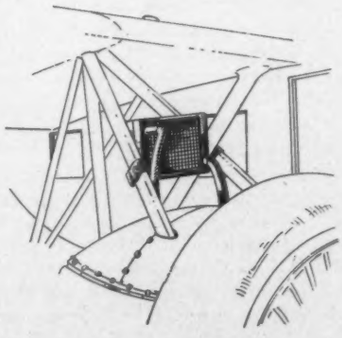
The method of attaching struts and fittings is worthy of note. A diamond-shaped hole is cut in each side wall of the tube before the end fitting is inserted. With the fitting in place and properly aligned with the bolt holes, the two pieces are welded together around the edges of the diamond-shaped hole as shown.

The ribs are formed of heat-treated duralumin. The chord members, both top and bottom, are of a modified channel cross-section with wide, turned back flanges. The web members are straight rolled channels and are assembled to the chord members by riveting with duralumin rivets. Short spacer tubes



Detail of wing construction of Consolidated Trainer

are used around the rivets to prevent crushing the channels. Completed ribs are assembled by sliding over the spars, and are held in place by nailing directly into the wood.



Oil cooler on Kingbird

Oil cooler for summer flying

AS originally installed, the oil coolers for the J-6 Wright engines of the Curtiss Kingbirds used by Eastern Air Transport, Inc., were located within the engine nacelles and supplied with air from a scoop projecting through the cowling. With this arrangement excessive temperatures were encountered

during the warm Southern summer months, and new oil radiators have been installed entirely outside the nacelles, fully exposed to the propeller slipstream. The radiators are of the honeycomb type and are mounted without farings of any kind between a pair of the nacelle supporting struts. Adequate cooling has been obtained, and there has been no indication that the total drag of the new arrangement is appreciably greater than that of the air scoop system.

Technical Abstracts

NAVY FLYERS AND NAVIGATION

A NEGLECTED PHASE OF NAVAL AVIATION, *by Lieut. Logan C. Ramsey, U.S.N. The U. S. Naval Institute Proceedings, August, 1931.*

IT MAY seem somewhat paradoxical to raise the question of the navigational abilities of naval officers, especially in a branch of the service where the importance of knowing one's location, or of reaching an objective is so obvious, but it is a fact that of the time given to training and practice of the three essential phases of naval flying, —airmanship, gunnery, and navigation, the latter receives relatively scant attention, and numerous incidents have testified to the need for greater proficiency in that art. An expert pilot, and a crack shot is of little use to the service if he is unable to locate his objective, or, having completed his mission, is unable to relocate his carrier, or base.

Pilots who are deficient in airmanship usually eliminate themselves sooner or later through accident, but in peace times, at least, deficiencies in the other two phases are harder to detect, and must be eliminated by thorough and continuous training. That this is well recognized in the case of the handling of aerial weapons is indicated by the fact that during the year 1928-29 naval aviators averaged 33 hours in the air on bombing or gunnery missions. During the same period, however, navigational training and practice averaged only 0.28 hours each. It is obvious that little attention is being paid to this branch of the work outside of the relatively brief courses that are given in navigation at Pensacola, and recently, the training of this sort at that station has been materially curtailed.

The introduction of carrier operations has made necessary an increase in the ability of the average pilot to find his way home when out of sight of the ship. As yet there have been no cases where ultimate contact has not been made, but there have been several incidents which have indicated clearly the need for more training and practice in navigation by the pilots of the ship squadrons unless the service is going to be content to limit the effectiveness of the carrier planes by tying them "to their mother's apron strings."

The first step in the remedy of this situation would be the re-introduction into the training program of adequate time and facilities devoted to navigation. More attention must be paid to the care and use of navigation instruments. For qualified pilots, flight by dead reckoning should be substituted for the following of landmarks as often as conditions of safety will permit. Each flying officer should be required to compensate and adjust his own instruments at least once a quarter instead of leaving these functions to the squadron navigator, and finally, some form of competition should be introduced which would develop as much interest in aerial navigation as is now evidenced in the other phases of naval flying.

AN AIRPORT SURFACING SURVEY

THE ASPHALT INSTITUTE SURVEY REPORT OF THE COMMITTEE ON AIRPORT SURFACING METHODS, *by William N. Carey.*

THERE are few technical organizations in the United States which have not at some time or another had their interest attracted by some phase of the aeronautical field. In many cases valuable contributions have resulted which could not possibly have been achieved by persons already in the industry. The present report is very much a case in point. Frank Hawkes, while addressing the 1930 Asphalt Paving Conference at which the report under discussion was presented, said "As an aviator, I am much more interested in flying than I am in the construction of a base port. Aside from the experience one obtains while learning or acting as a training pilot at an airport, and in such capacity repeatedly landing and taking off from the same runway or set of runways, one obtains little or no intimate knowledge of the actual construction of the runways at any particular airport, other than knowledge as to whether they are smooth or rough, or good or bad."

If ever there was a problem of real importance to aeronautics for which flyers, aeronautical engineers, and even constructors of hangars are not technically equipped, surely it is that of airport surfacing. Recognizing this, the Asphalt Institute and the Association of Asphalt Paving Technologists created a committee on airport surfacing headed by Mr. Carey. A general survey was carried out of the large majority of fields of real importance in the United States. A number of interesting trends were noted and suggestions made.

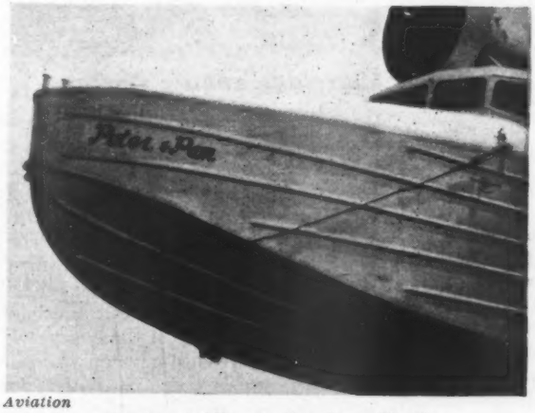
Practically all of the airport surfacing and paving in place today has been put down within the last two or three years. Experience in its problems is therefore very slight compared to that possessed in street and highway problems. To aid in the detection of definite standards of practice a very complete questionnaire was sent out to approximately 800 persons. Replies were secured from 153 airports which fortunately included nearly every important one. Questions were asked as to extent and type of paving, cost, methods of treatment, difficulties and maintenance, followed by a number of inquiries as to preferences of type and specifications. Based on actual returns, asphaltic types of surfacing have been laid almost 8 to 1 to those of other types. Cost results varied over wide limits. A divergence from $0.22 per square yard for thin bituminus surface treatment to $1.75 for 2-in. hot mixed asphaltic concrete on 3-in. black base seems to indicate not only a wide divergence in soil conditions but also a wide difference of opinion among engineers as to the expense justified for runway surfacing. The average cost per square yard for Portland cement concrete was $1.67. Of 41 replies on preferences, 24 named some sort of asphalt treatment, 6 Portland cement, 9 turf, and 2 miscellaneous; 100 ft. seemed to be the consensus of opinion as to the minimum width desirable for runways. A large number of important airports are discussed individually in the report and the descriptions of them should serve as very excellent suggestions for future constructions and designs. A very interesting point is made on the subject or rigidity. It is the opinion of the committee that there is no practical difference in mechanical reactions within a landing airplane due to differences in surface construction as long as the surface material has sufficient stability to withstand the impact without the excessive and permanent displacement or cutting. This belief can be supported mathematically. Texture seems much more important especially for smaller planes carrying tail skids and no brakes.

All in all, the Asphalt Institute is to be commended for the interest and general method of attack they have applied to our surfacing problem.

Servicing Short Cuts

A TOWING BRIDLE FOR FLYING BOATS

SOME seaplanes and flying boats behave very badly when an attempt is made to tow them from cables attached to bow chocks in the ordinary manner. A towing bridle which has been designed to overcome this difficulty is shown mounted on a Saro Cloud amphibion in the accompanying photograph. The main towing rope is attached at a point on the keel well below the normal water line, and passes through a running eye in a short piece of cable attached to a ring at the bow. When not in use for towing purposes, the free end of the cable is attached to a chock within easy reach of the pilot's cockpit. A short loop of cord takes up the slack in the towing cable.



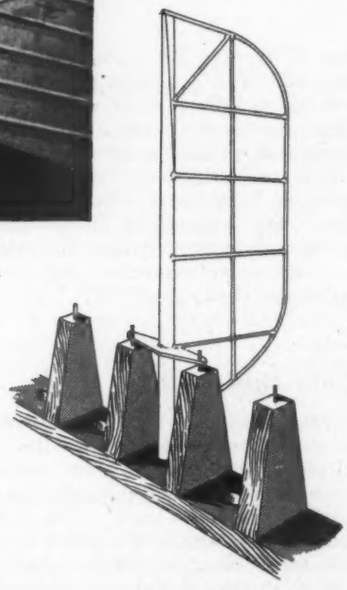
Aviation

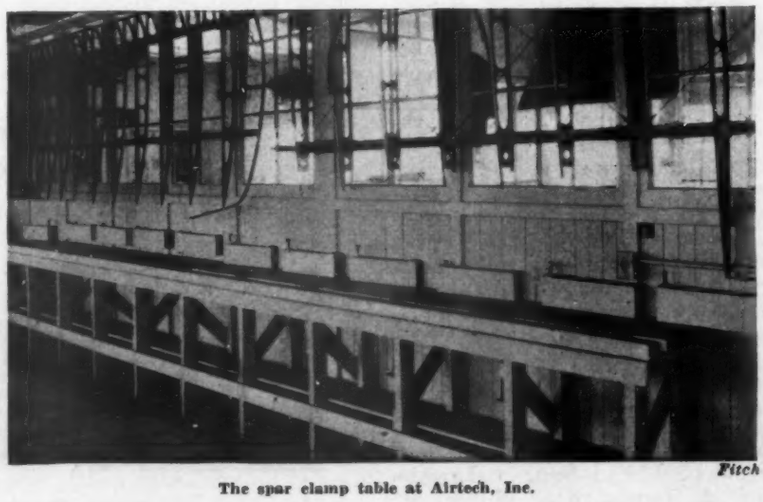
Towing bridle on the Saro Cloud

SPAR ASSEMBLY JIG TABLE

TO repair damaged wood spars, or to build up new ones to factory specifications, the shops of Airtech, Inc., of San Diego, Cal., have found it economical to maintain a spar jig table large enough to clamp the largest wood spars now in commercial use. This equipment saves the cost of a set of glue clamps, saves materially on labor, and makes it possible to make absolutely straight spars.

The table consists of a 2x12-in. wooden plate firmly supported by well braced upright members at 2-ft. intervals along its length. Heavy transverse members, held down and adjusted by large through bolts, are spaced along the plate at approximately the same intervals. After a spar is assembled on the table, an additional 2x12-in. wooden member is placed on top, and the transverse clamping pieces pulled down tightly by taking up on the clamping nuts. In this manner the spar is firmly held along its entire length while the glue dries.





Fitch

The spar clamp table at Airtech, Inc.

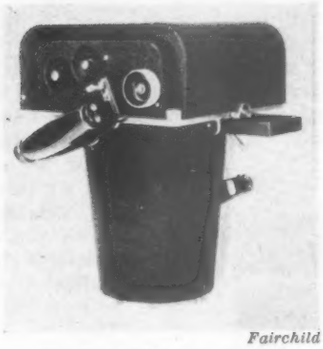
RACK FOR CONTROL SURFACES

A SIMPLE and effective rack for supporting airplane elevators during re-covering or doping operations is in use in the fabric shop, of the Atlanta repair depot of Eastern Air Transport, Inc. A series of short hard-wood posts are mounted securely to a wooden base so that the center to center distance between each is approximately equal to the distance between clevis pin holes of the control horns of the elevators. A short metal pin is driven into the top of each post, and a hole of a diameter greater than that of the elevator spar tube is drilled in the base midway between each set of uprights. With the holes of the control horn over the pins, and the end of the spar resting in the socket in the baseboard, the elevator frames are held firmly in an upright position where any required work may be conveniently performed. The length of the rack is determined by the number of elevators which may have to be handled. When a number of frames are mounted in the rack at the same time, they are placed so that they project alternately to the right and to the left, thus doubling the working space around each frame.

The Buyers' Log Book

Aerial camera

An aerial camera designed especially for use of newspapers, sportsmen, business organizations, and operators desiring to extend their activities to include aerial photography has recently been announced by the Fairchild Aerial Camera Corporation of 270 West 38th St., New York City. The camera takes 5x7-in. photographs, and is suitable for aerial mapping, oblique photography from air, or close range pictures on the ground. The fact that it uses cut film, roll film, or plates makes it particularly suitable for amateur use, as it is unnecessary for the purchaser to provide himself with the extensive special dark room equipment needed to develop the long length of roll film usually used by such cameras. Furtherfore, plates and cut films can be secured through local photographic stores. The new camera, which is known as the F-8, is constructed entirely of metal, and is designed for simplicity and handling, both on the ground and in the air. A special model differing slightly from the regular commercial camera is also available for military use.—AVIATION, *September, 1931.*



Fairchild

The Fairchild F-8 camera

Beldon cable

Ignition cable

Ignition cable especially developed to resist oil and wear due to vibration has been announced by the Belden Manufacturing Company, 4689 West Van Buren St., Chicago. Tinned copper cable (19x27) is embedded in a rubber insulating compound. A lacquer impregnated cotton braid is next applied, over which is wound varnished cambric tape. An outer coat of lacquered cotton braid completes the assembly. Cable is designed for use on automotive or airplane engines where trouble from oil splashing is experienced.—AVIATION, *September, 1931.*

Brazing alloy

A new brazing alloy said to flow freely at 1,300° F., is being marketed by Handy & Harman of 57 William St., New York, N. Y., under the trade name of "Sil-Fos." The new material promises to be applicable where higher melting point base metal brazing or welding alloys cannot be used, without danger of weakening, distorting or destroying the parts adjacent to the joint. The presence of phosphorus in the alloy is said to reduce the amount of flux which must be employed.—AVIATION, *September, 1931.*

Radio equipment

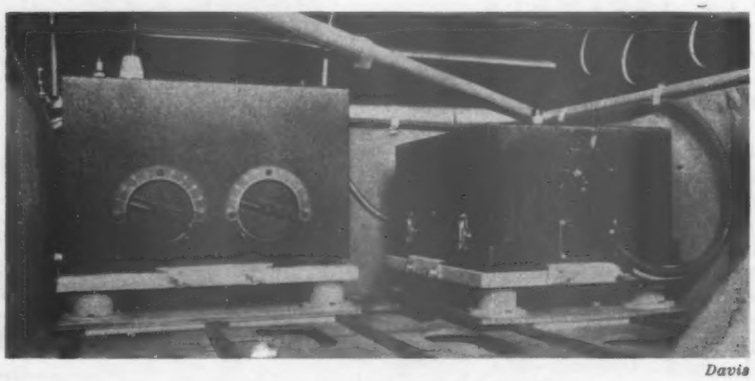
Transmitting and receiving equipment for aircraft use, designed by the Bell Telephone Laboratories, has recently been announced by the Western Electric Company of New York. The transmitter is controlled by the quartz crystal oscillator method which automatically holds to the prescribed frequency without the necessity of tuning. High percentage modulation assures maximum output with minimum distortion. The receiver is of the beacon type, and covers the entire band of frequencies for aircraft services so that it can be used in conjunction with low frequency transmitters at airports, as well as for receiving Department of Commerce reports. The entire installation of transmitter receiver and auxiliary equipment weighs approximately 80 lb.—AVIATION, *September, 1931.*

Cartridge engine starter

The Standard Aero Starter Company of Pittsburgh, Pa., has announced a new type of cartridge starter for airplane engines. The apparatus includes a dash mounted breech block fitted to fire a standard shot gun shell electrically from A small flashlight battery, connected by a tube to an expansion chamber and self-contained starting mechanism mounted on the rear of the engine. The starter is reported to develop 45 hp., and is said to weigh less than half a pound per horsepower developed.—AVIATION, *September, 1931.*

Stainless steel manifold

The Solar Aircraft Company, Ltd., of San Diego, Cal., has developed a special sectionalized stainless steel exhaust manifold for use on Cirrus and Pratt & Whitney Wasp engines built up by welding stainless steel stampings. They are made in sections and assembled with slip joints between each section to take care of heat expansion without causing undue strains on the cylinder heads. A complete manifold for a Cirrus engine weighs 2 lb. 12 oz. complete. Manifolds of similar designs can be made up to fit practically



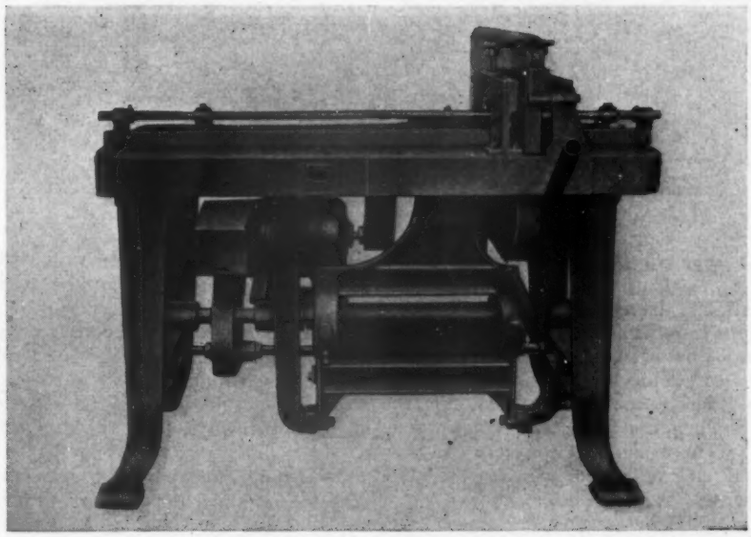
Davis

Western Electric aircraft radio installation

any standard aircraft engine.—AVIATION, *September, 1931.*

Cut-off machine

Designed particularly for cutting to length flat bar stock up to 1 in. thick and 16 in. wide, a new abrasive disk cut-off machine, known as the Model 30, has been put on the market by Andrew C. Campbell, Inc., of Bridgeport, Conn. The stock to be cut is held stationary on the table, and the cutting disk is moved through the material. Controls are conveniently located, and safety guards are provided for the protection of the operators.—AVIATION, *September, 1931.*



Campbell cut-off machine

Compression spring tester

Production testing of compression springs for stiffness is accomplished by the use of a new device recently placed on the market by the Toledo Precision Devices, Inc., a subsidiary of the Toledo Scale Company of Toledo, Ohio. Springs to be tested are placed in sockets on a disc which is intermittently rotated under the testing head. Each spring is compressed to a predetermined length, and the expansive force registered on a large dial. The springs are then discharged through a swinging chute, those of proper stiffness dropping into one bin, those which are too stiff into another, and those not stiff enough into a third bin. The machine may be adjusted to handle various sizes of springs and to select on a basis of a wide range of load tolerance.—AVIATION, *September, 1931.*

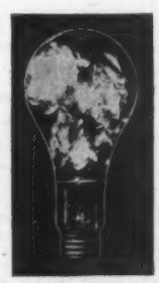
Toledo compression spring tester

Power amplifiers

Amplifier units for use in connection with radio broadcast reception, or public loud speaker systems, are being marketed by the General Amplifier Company, 27 Commercial Ave., Cambridge, Mass. These units come in sizes ranging from a two-stage power amplifier for home and small auditorium use, to the largest multi-tube set designed for mounting on a standard relay rack for airport or auditorium announcing system.—AVIATION, *September, 1931.*

Photoflash lamp

For making photographs of airplanes in dimly lighted hangars, or for photographing interiors of aircraft, the use of the newly developed photoflash lamp eliminates the fire hazard involved with ordinary open flashlight equipment. The lamp, manufactured by the General Electric Company, is being widely distributed through retail dealers. It consists of a container similar in shape to an ordinary lighting bulb (including a standard screw base), enclosing a quantity of loosely packed aluminum foil in an atmosphere of oxygen. Contact with a suitable source of electric current produces a brilliant, noiseless, smokeless illumination. Each bulb can be used for only one photograph. AVIATION, *September, 1931.*



The photoflash lamp

Catalogs

Armco Culvert Manufacturers Association. Catalog No. 4 entitled "Armco Perforated Pipe" has been received from the Armco Culvert Manufacturers Association of Middletown, Ohio. Among several municipal and industrial applications of this material, its use for airport drainage systems is described and illustrated.

Norma-Hoffmann Bearings Corporation. The application of ball bearings to aircraft and aircraft engines is covered by the Norma-Hoffmann Bearings Corporation of Stamford Conn., in a new bulletin entitled "Precision Bearings for Safe Flying." The book does not contain a complete catalog of the bearings manufactured by this company, but rather a series of photographs and lists of special ball bearing applications.

Continental Diamond Fibre Company. The manufacture, and a wide range of application of Diamond Vulcanized Fibre are fully described in the new booklet of the Continental Diamond Fibre Company of Newark, Del. The book includes the standard and specification adopted by the National Electrical Manufacturers Association and contains also a group of tables of weights, etc. useful in making calculations involving structures, using the various forms of fibre.

Side Slips

By ROBERT R. OSBORN

Thoughts on the depression

THERE have been many attempts lately, by writers and public officials, to end this here, now, depression we are experiencing, by prophecies of good times coming soon and talk along the line of "brighten the corner where you are." There has been much of this sort of writing in our newspapers and magazines, and the same theme runs through our motion picture and radio programs. Inasmuch as this propaganda has had the surprising effect of making our depression much worse, so that now we have even nations on the verge of bankruptcy, a very different method of attacking our problem is obviously needed. This new method of attack has occurred to us, and we herewith propose it to the aviation industry, with the suggestion that we get started on it when we all get together for the National Air Races at Cleveland. The scheme is quite simple, and, briefly, is this: Instead of trying the Pollyanna stuff on each other, let's see if we can't talk ourselves further into the depths of despond. Let's try to drive ourselves so far down so quickly that possibly we'll come out on the first bounce. Instead of grasping at the few remaining twigs on the bank, let's dive in and get the ducking over with. Instead of spending all this time skipping the clouds how about flying into the middle of them and trying some blind flying for a while—maybe we'll be coming spinning out into the bright sunlight? There, you see? We have you confused already.

We were reading in the news the other day that two airplane companies had been merged, and one of the plants had been closed down. Commenting on this to a friend, we wondered what the reason could be for merging those two companies, and he suggested that possibly it was to save the wages of one watchman.

There's the sort of talk we need. Let's have more of that.

For engine manufacturers who have a large inventory bothering them, we can call attention to Fred Becker's suggestion that if you can't do anything else with an airplane engine you can always throw it overboard and sell it as a mooring for a motor boat.

We remember meeting Fowler Barker at the National Air Races last year, he just having returned from a survey tour of the country. He said that as a result of his tour he could state that the biggest problem in aviation at that time was how to grow cotton on concrete runways. This year the biggest problem is, undoubtedly, what to do with the cotton that was raised on the concrete runways.

Did you hear about the fellow who stopped a couple of people on the street in Wichita, Kan., and asked where he might buy an airplane and the poor chap was trampled to death in the resulting riot? No, we hadn't heard it either, but it's a good story to get started.

The Intrepid Aviator dropped in the office about an hour ago, and after a few complaints about the cheaper cigars we are smoking nowadays, said these so-called hard times didn't bother him very much and if only the Department of Commerce would quit bothering him about his Jenny, things would be about the same with him as they used to be.

Just in case you had not realized the extent of the depression, read over the following from a New York newspaper:

"25-PASSENGER AIRPLANE IS USED AS HOT-DOG STAND. New York, June 12 (AP) A 25-passenger transport plane, costing $100,000 is being converted into a hot-dog stand. George Anderson of Flushing, bought it for $500 and intends to set it up in a vacant lot to atract the customers at a dime a throw."

If this enterprise turns out as might be expected we shall have an item for you in our next issue that Mr. George Anderson had failed to make money and is in bankruptcy.

We read that a deaf mute learned to fly after eleven hours instruction, at a field near Windsor, Ontario. We are familiar with the system of signals the pilot must have used to indicate the maneuvers he wanted, but he must have had to develop an entirely new set of signals to cover the profanity that goes with the instruction.

Speaking of profanity and such, a recent news item stated that a friend of ours had been arrested for calling a Nassau County, Long Island, policeman a "dirty name." His defense, which he backed up with some reliable witnesses, was based on the fact that all aviators use profanity and that it is essential to the business. Of course this is true to a certain extent, but profanity is becoming less necessary in the actual flying, as planes are becoming easier to fly and engines more reliable. Its greatest use in the business just now is in discussing the financial side of it, and, of course, it is absolutely essential when referring to policemen of the Long Lsland variety. And so, it seems to us, the legal question to be settled in this case is not whether the pilot called the policeman a dirty so-and-so, but whether the dirty so-and-so is a policeman.

While we are getting downright mean about this depression business, this might be a good time to inquire what has become of all of those towns which used to be the aviation center of the United States?

As always, however, we can rely on our California colleagues to be doing the unusual and startling. Lately they have given up changing airplane engines and wheels in mid-air, and have gone in for production schedules which stagger the imagination, according to the latest information from C. F. McR. His clipping from the May issue of the Los Angeles Chamber of Commerce Bulletin, states: "Such internationally recognized manufacturers as . . . ., ..., ..., and others—with production schedules which stagger the imagination, have placed Los Angeles County far in the lead as an aircraft industrial center."

If there were any particularly ragged formations in the recent Army maneuvers they might be accounted for by pilots in the group who couldn't make their feet behave. The report has reached us from Bill M. of Curtiss Field, Valley Stream, Long Island, that an open air shower bath was set up for the pilots when they stopped at that field, and it was discovered after they left that it had been located in a bed of poison ivy.

Suggested slogan for the Cleveland Air Races this year: "Are we downhearted? *Yes!*"

Our Hangar Flying Department

MR. G.I.S. made a trip recently on an air transport line which employs a hostess as part of the crew of each plane. The girl on this particular plane seemed to be quite bright and cheery, so, when he had an opportunity to talk to her, Mr. G.S.I. thought he'd find out how much she knew about flying and aviation in general. He asked her a number of questions on those subjects which she answered very well, and then asked her a question which he thought would be difficult to answer,—but obtained what we agree was a clever answer. "Do these engines ever stop?" he asked. The hostess said, "Good Lord! I hope not."

33 Years of Experience in making and applying Timken Bearings

1898—The first Timken Bearing had no cage. This caused excessive friction due to contact of the rolls revolving against each other in opposite directions.
1898—Separation of the rollers by spacing them with small pilots integral with the rollers' heads.
1903—A one piece cage made from sheet steel by a series of press operations.
1909—A single rib on each roller reducing the width of the bearing and giving greater compactness without sacrificing capacity.
1917—Elimination of the wings on the cage, simplifying the construction and operation of the bearing.
1919—Elimination of both ribs from the roll ends still further increasing the compactness and capacity of the bearing.
The Timken Bearing of Today—Maximum Capacity with Minimum Friction.
Material: Timken-made steel.
Design: A full complement of rollers uniformly spaced around the cone by a truly perforated cage, thus uniformly distributing the load and eliminating internal friction. The rollers are also positively aligned longitudinally by two-area contact on the cone rib.

A third of a century marked by a continuous series of engineering accomplishments in taking friction and headaches out of one industry after another.

The successful application of an anti-friction bearing to any industry or to any type of equipment vitally requires two basic factors. *First*, correct bearing design, material and construction. *Second*, long experience in applying the bearing to meet individual specialized problems.

The first of these factors has been taken care of by one improvement after another over a period of 33 years.

The second factor—experience—is equally important, both to machinery makers and users. Timken's 33 years of experience show that it takes several years to thoroughly prove out a bearing in any industry. Furthermore, it takes many years to develop the proper refinements in a product for the specialized service of any given industry—such refinements as the correct heat treating, the necessary precision processes of manufacture, and the proper engineering of bearing mountings. These things come only from minute contact and serious study of the actual operation of the bearing in the field over a period of many years.

Timken Bearings have long since passed that period. The great body of Timken users know that when they buy a Timken-equipped machine they are not experimenting, but that they have the two factors necessary for satisfactory machine operation—the correct bearing, *and* Timken's long experience in applying, mounting, enclosing and engineering that bearing for specific applications.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

STARTING

right WITH TEXACO

THE Dallas Aviation School and Air College, one of the largest in the southwest, uses Texaco Products exclusively. Student flyers start right with the finest in fuels and lubricants at this school. It is one of the best equipped and most successful aviation schools in the United States. Fifteen ships, modern in every respect, are available for student use with complete class-room and shop facilities for thorough ground training. More than a million dollars worth of airplanes are housed at the Dallas Aviation School, Love Field, Dallas, Texas, every night.

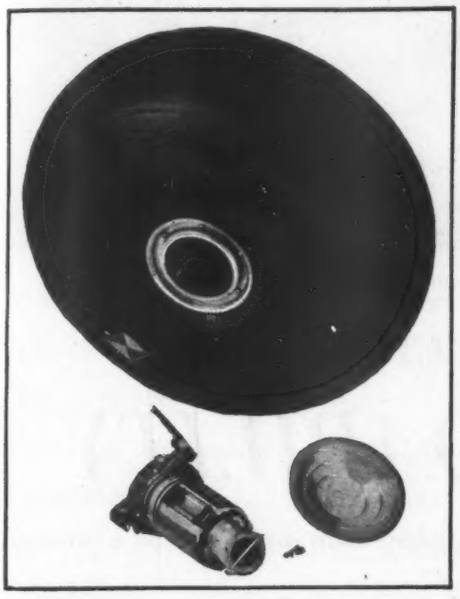
Texaco Aviation Gasoline, Texaco Airplane Oils and Texaco Marfak Greases are furnished from servicing equipment at the field. These products, here, as at many other of the country's foremost flying schools, were selected because of their proved excellence in performance, their dependably uniform high quality and service. The Dallas Aviation School and Love Field are 100 per cent Texaco.

You will find Texaco Aviation Products at principal airports throughout every section of the country.

THE TEXAS COMPANY, 135 East 42nd Street, New York City

TEXACO AVIATION GASOLINE
TEXACO AERODIESEL FUEL
TEXACO AIRPLANE OILS
TEXACO MARFAK GREASES
TEXACO ASPHALT PRODUCTS
FOR RUNWAYS, HANGAR FLOORS AND APRONS, AND DUST LAYING.

"WITH ANY OTHER TYPE OF LANDING WHEEL *it would have been extremely dangerous*"



THE following letter from Lieut. Winston W. Kratz, Aeronautical Corporation of America, tells such a vivid story of Airwheel safety that we let it speak for itself:

"While flying across the low swamp-lands of southern Alabama and Louisiana, the rain and fog had forced me to the very tree-tops and for fully half an hour, due to the fact that there was no possible landing space available, I was forced to fly with my wheels almost clipping the foliage.

"The situation became so bad that I determined to land at any spot that gave me a possibility of even cracking up safely.

"Finally a marsh appeared. It was so covered with water that the grass was barely discernible. I shot it once at about a 10 foot altitude and since it was all of equal wetness I circled once more and with something like a prayer on my lips glided in for landing. To my great surprise, the ship did not nose over though it rolled not more than 20 feet upon landing and the tail was kept down only by holding the stick all the way back in my stomach and constantly blasting the motor.

"The following day the fog lifted somewhat, though the rain had not abated. I took out all possible weight, drained all but two gallons of gasoline, started the motor and, after warming it for several minutes, taxied with the aid of a couple of road workers to a position at the far end of the marsh. I shoved the throttle forward but kept my stick well back. When I eased up on the stick, even as much as an inch, the tail would immediately lift and I knew that my only chance was to stall out. Finally the ship seemed to positively skip over the water and actually lifted out of that thick mud and water.

"There is no question but that with any other type of landing wheel such a take-off would not only have been totally impossible but it would have been extremely dangerous. I want to say that I am as thoroughly sold on Goodyear Airwheels as it is possible for anyone to be sold on any product, and I feel that I owe your company a vote of thanks for the service my airwheels rendered me on that occasion.

"While at Miami I had the pleasure of seeing your pilot, Mr. Hudson, and he told me the very interesting news that you now have brakes for wheels of the type which we are using. I am very anxious to get a set of these wheels with brakes as I would like to give them a thorough try-out. I frankly believe that our light ship equipped with braked-wheels will be able to do some rather marvelous things in its take-off.

"It was a pleasure to see you about two months ago at Akron and I hope that we will be able to get together in the near future."

Now that Goodyear Airwheels cost no more than other wheel and tire equipment, can you afford to fly without them? For full data, write to Goodyear, Akron, Ohio, or Los Angeles, California.

When you buy a new ship specify Goodyear Airwheels

GOODYEAR

EVERYTHING IN RUBBER FOR THE AIRPLANE

View of the Final Inspection Department of the Hamilton Standard Propeller Corporation

THE CONTRIBUTION OF RIGID INSPECTION TO . . .

PROVEN DEPENDABILITY

The completeness and thoroughness of the inspection of Hamilton Standard Propellers, from the raw forging to the finished product, is in keeping with the vital importance of *dependability* in aircraft propellers.

Inspection starts at the plants supplying us with blade and hub forgings. Sworn reports accompany each and every forging, giving the results of tests made on test pieces forged and heat treated with each forging. Each and every forging, whether for government or commercial use, must meet government specifications. Government Inspectors are stationed at each of these plants.

In our own plant we make a second series of inspections and physical tests of the forgings. Each step in fabrication is checked by a process inspection.

The illustration shows a portion of our Final Inspection Department where a final check is made of every element that has a bearing on efficiency, dependability or uniformity of product. Every blade is again etched and minutely inspected for flaws.

Finished hubs are checked by a magnetic detector for the possible existence of seams or cracks not otherwise detectable, even by the use of a high-power lens. Propellers that successfully pass through all these inspections are then, and only then, considered fit to bear the Hamilton Standard escutcheon to the four corners of the world.

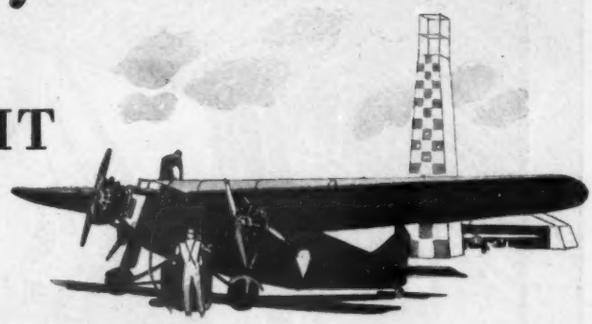
HAMILTON STANDARD PROPELLER CORPORATION

PITTSBURGH, PENNSYLVANIA

HAMILTON STANDARD PROPELLER CORPORATION

DIVISION OF UNITED AIRCRAFT AND TRANSPORT CORPORATION

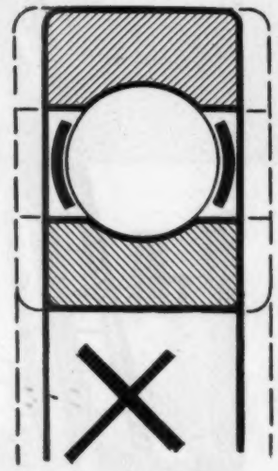
Greater Capacity
PER POUND
OF BEARING WEIGHT
with the
SRB TYPE "V"
AVIATION BALL BEARING



WEIGHT is a vital factor in every detail of aircraft design. Engine manufacturers are constantly endeavoring to lessen the weight per horsepower and still maintain the highest possible factor of safety. As a direct contribution to this ideal, SRB engineers developed a special aviation ball bearing . . . that saves from 13.8% to 26.6% of the weight of its corresponding standard bearing equivalent . . . that does not sacrifice any of its load carrying capacity with this decrease in weight.

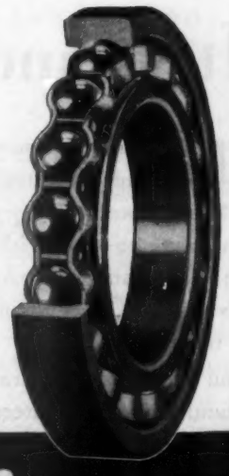
With the "V" type Aviation Ball Bearing, SRB engineers have given the aviation industry a bearing that possesses the greatest load carrying capacity per pound of bearing weight.

You will find this bearing being used today by many of our foremost engine manufacturers . . . for taking propeller thrust . . . for supporting the crankshaft, front and rear. It is a proven bearing that has stood the time-test in these severe service applications.



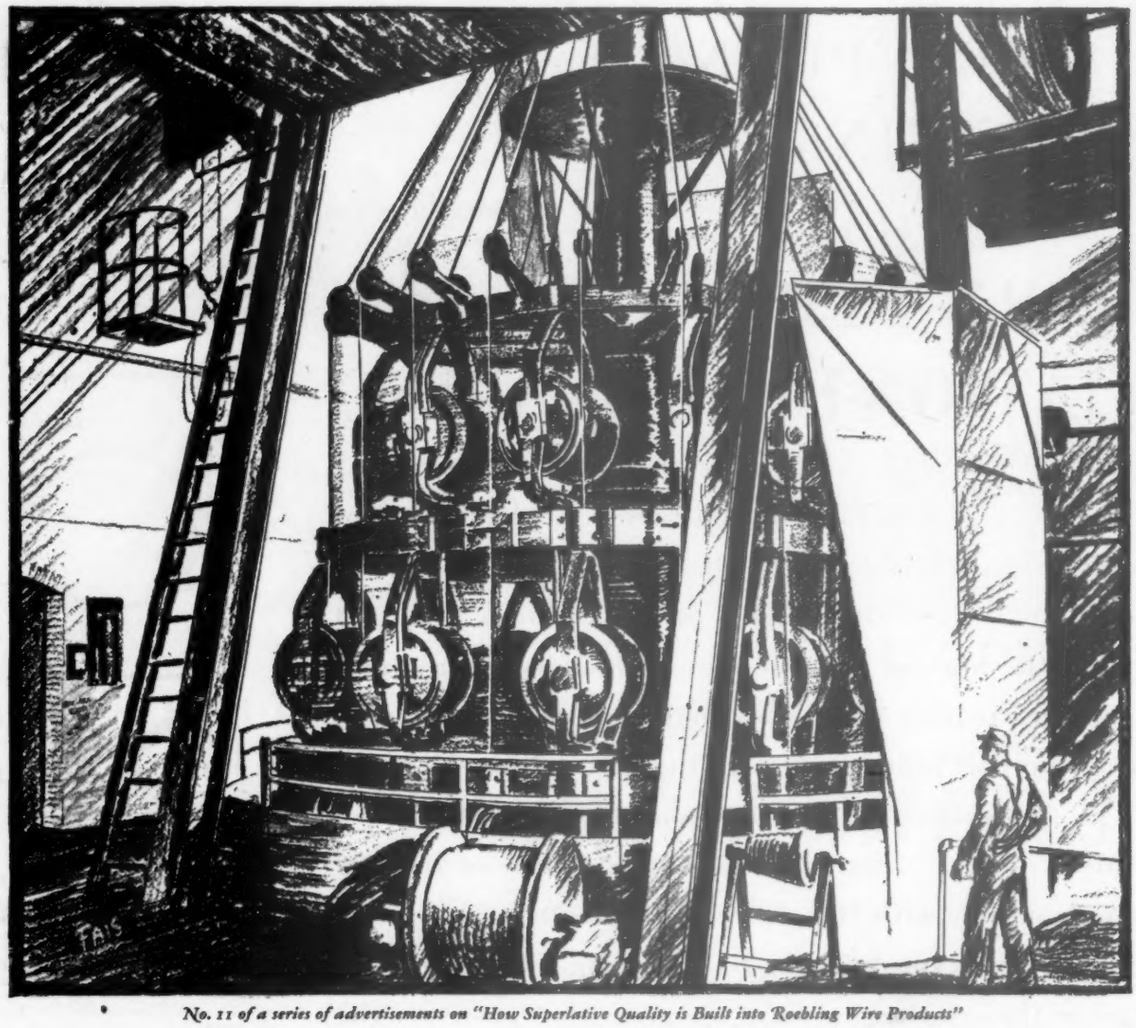
13.8%—to—26.6%
LESS BEARING WEIGHT

The outline above, drawn to scale, shows the SRB Type "V" Aviation Ball Bearing (size 213V), superimposed on the SRB "Maximum Capacity" Ball Bearing (size 213). The dotted lines show the amount of material saved by the SRB Type "V". In this case the weight saved amounted to 23.1% or .53 pounds.



STANDARD STEEL AND BEARINGS INCORPORATED
DIVISION OF MARLIN-ROCKWELL CORPORATION
Plainville ***Connecticut***

Ball SRB Bearings



No. 11 of a series of advertisements on "How Superlative Quality is Built into Roebling Wire Products"

It strands 37 wires *in one operation*

THIS giant spins—not fine, soft yarn—but "threads" of steel. It can take as many as 37 tough steel wires—each almost a quarter inch in diameter—and with surprising ease "lay" them into a great steel strand of tremendous strength. Each of its 36 whirling bobbins holds over half a ton of wire.

But it is not the dramatic in this Titan that should especially interest the buyer of wire products. Rather, it is the fact that this machine is a striking example of the great lengths to which Roebling goes to engineer into every Roebling Wire Product a maximum of safety and stamina.

One of the many stranders at Roebling, this particular machine makes possible the production of *highly efficient* large diameter ropes, possessing an exceptionally high degree of pliability. It makes strands for these ropes *in one operation*—assuring maximum metallic content for any given cross-sectional strand area. This means greater strength and less internal wear.

JOHN A. ROEBLING'S SONS CO., TRENTON, N.J.
Branches in Principal Cities *Export Dept.: New York*
WIRE • WELDING WIRE • FLAT WIRE • COPPER AND INSULATED WIRES AND CABLES • WIRE CLOTH AND WIRE NETTING

ROEBLING WIRE AIRCRAFT PRODUCTS

One of 21 White Coaches owned by the Boston, Worcester & N. Y. Street Railway, four of which are in New York airport service.

A Vital Service TO AIR-LINE PATRONS

TO and from the airport with the utmost convenience and comfort, with all the ease of travel that is afforded by luxurious White equipment . . . such is the service provided for patrons of Eastern Air Transport, Inc., and the Colonial division of American Airways between the midtown section of Manhattan and the busy Port Newark.

Every departure and every arrival is met by these modern ground transports, rigidly and comfortably maintaining their schedules.

More and more, operators are realizing the importance of this part of their service—its effect on the BUILDING and HOLDING of traffic.

Because air travel begins and ends with ground travel, the ground journey must be comparable in comfort to that of the airplane. Whether coaches are transport-owned, or under contract, it is important that high standards be maintained . . . which is one of many reasons why Whites are used where no "let-down" is tolerated.

The natural needs of transport service and the complete line of White coaches combine to make White equipment a logical auxiliary of air travel. White has a special Motor Coach department to assist in selecting the right type of equipment for each operating situation. Literature on request.

The WHITE COMPANY, *Cleveland*

BRANCHES AND DEALERS IN ALL PRINCIPAL CITIES

White

A COMPLETE LINE OF TRUCKS AND COACHES

Here's a real "buy"

For profitable short-haul flights

With every airport thronged with people who want to "go up," here is an unusual opportunity to cash in on the public's air-mindedness.

For immediate sale we have made some very attractive low prices on a few Super-Universals and other Fokker planes that have been used as demonstrators, including—

SUPER-UNIVERSAL	F-14A MAIL PLANE
STANDARD UNIVERSAL	F-10A TRIMOTOR

The Super-Universals are an especially profitable "buy" for feeder lines, sightseeing, charter and taxi work. They have six pay-load passenger seats and baggage or lavatory room. Extra-sturdily constructed and powered with a Pratt & Whitney 425 h.p. "Wasp" motor, they are built to stand the wear and tear of short hops — *economical to operate, speedy, durable.*

All these ships are in first class mechanical condition. They can't be told from brand-new planes and each is fully guaranteed. If you would like to purchase a fine ship at a worth while saving, write for prices. They won't last long.

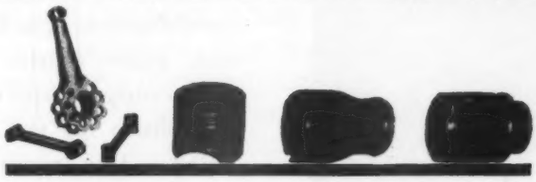
• FOKKER •

DIVISION OF GENERAL AVIATION CORPORATION

FOKKER AIRCRAFT CORPORATION OF AMERICA, GENERAL MOTORS BUILDING, NEW YORK

TIME

HAS TURNED THEORIES INTO



FACTS...

UNPROVEN theories have no place in the air, and only the test of time will prove theories as facts. The test of time alone will discover engineering soundness and segregate the practical from the impractical.

Engines may be designed on guesswork, but these engines should be accorded no place in aviation where safety is paramount. Proven theories—facts—are the property of only the best engineers and engineering talent is not hastily developed but built carefully and methodically by years of experience upon a background of solid, proven principles.

At the shops of Govro-Nelson, aviation engine manufacturers are drawing upon the vast resources of theories proposed and developed at the highly regarded Arts & Metiers College of France, tested and proven in a million motor cars on the highways of the world, on the cinder track in famed racing cars and in the air.

At the shops of Govro-Nelson, time has turned theories into facts. Airplane engine manufacturers are using Govro-Nelson machinings with full confidence that they are precisely designed and accurately manufactured with a character fully worthy of their own products.

THE GOVRO-NELSON COMPANY

1931 ANTOINETTE DETROIT

CRAFTSMEN TO THE AVIATION INDUSTRY

It Isn't *Smart* to Fly Without a Parachute —It's *Dumb*

You may think these are harsh words, but we believe it's time somebody spoke plainly regarding Aerial Life Saving Equipment. Today a vast number of Commercial and Private flyers do not wear parachutes — some of them foolishly think it a sign of weakness, and yet, the Army, Navy, Department of Commerce and Air Mail Pilots — the finest flyers in the country — wear parachutes. No government plane is allowed to leave the ground unless each passenger is wearing a chute. It is a recognized safety factor. Surely this is proof enough that every plane should be equipped with parachutes for pilot and passengers, to have means of safely unloading in case of trouble. Hundreds of flyers' lives have been saved by parachutes and many more lives could have been saved in fatal accidents had chutes been worn. For your own safety and the future of aviation, wear a parachute. You may never need it, but if you do, it will save you from a tragic end.

Switlik Safety Chute, the chute with the one piece combination pack cover and pilot chute, is the most compact and efficient parachute on the market today. The recent Navy purchase of 200 Switlik Safety Chutes is the first time in Navy history that an individual chute made outside of Navy specifications has been accepted by the Service. . . A good reason why you should buy a Switlik Chute NOW.

Switlik Safety Chutes are Used by the NAVY, Dept. of Commerce, Air Mail and famous Flyers

Write for Details of Our

EASY PAYMENT PLAN

SWITLIK SAFETY CHUTES

SWITLIK PARACHUTE & EQUIPMENT CO.
TRENTON, NEW JERSEY

WESTERN MANAGER—BERT WHITE—1223 AIRWAY—GRAND CENTRAL AIR TERMINAL—GLENDALE, CALIF.

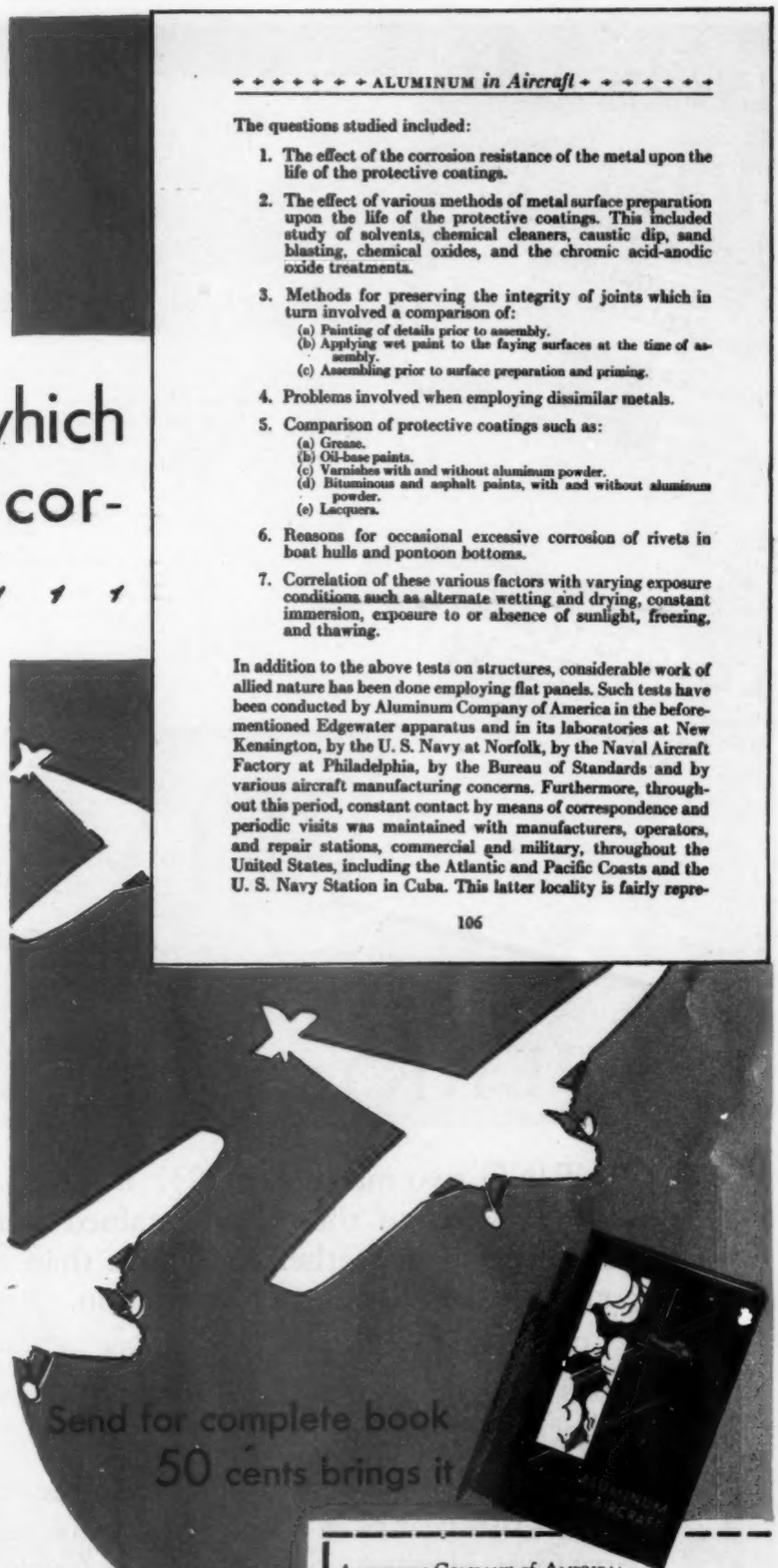
The 7 things on which they based the corrosion study . . . .

They, as the page shows, were the U. S. Navy, The Naval Aircraft Factory, the U. S. Bureau of Standards, various aircraft manufacturers, besides our engineers. Fourteen years were spent to get the facts, and now they are available for just 50 cents.

The tests included both factory and laboratory experiences. Base metals and finished parts from propellers to pontoons were covered. Experiments were made in all seasons. Special study was given conditions in the Tropics, where corrosive influences are severe.

There are 160 pages in this book. It contains the complete story of what Alcoa Aluminum and its light strong alloys are doing for aircraft. Here are the vital facts about the natural trend to metal, fabricating practice, forms, specifications, etc. It is an all round book, checked by aircraft manufacturers and many government agencies.

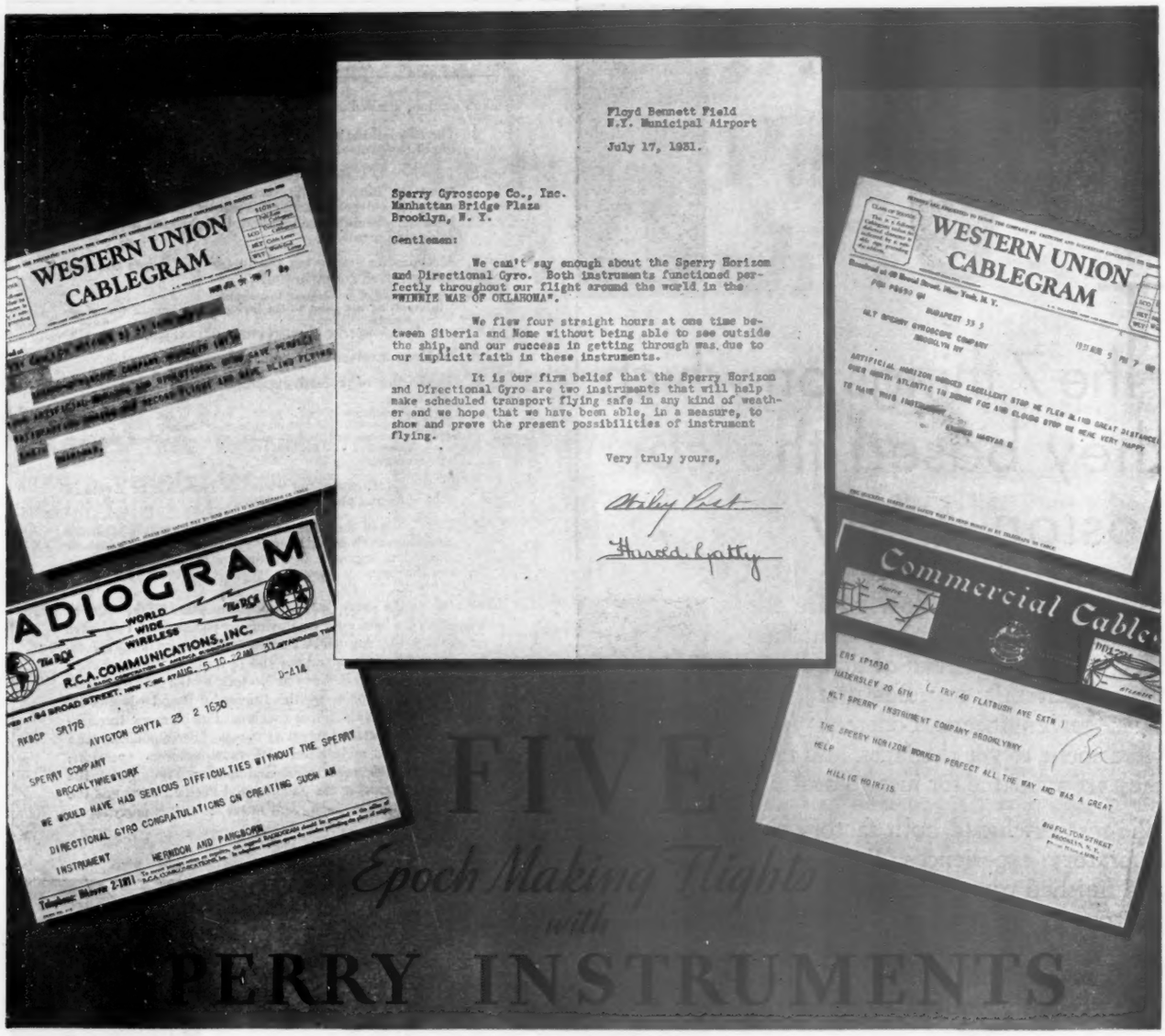
You'll want a copy. Send for it right away. Use U. S. Postage Stamps if you prefer. ALUMINUM COMPANY *of* AMERICA; 2482 Oliver Building, PITTSBURGH, PENNSYLVANIA.


ALUMINUM *in Aircraft*
The questions studied included:
1. The effect of the corrosion resistance of the metal upon the life of the protective coatings.
2. The effect of various methods of metal surface preparation upon the life of the protective coatings. This included study of solvents, chemical cleaners, caustic dip, sand blasting, chemical oxides, and the chromic acid-anodic oxide treatments.
3. Methods for preserving the integrity of joints which in turn involved a comparison of:
(a) Painting of details prior to assembly.
(b) Applying wet paint to the faying surfaces at the time of assembly.
(c) Assembling prior to surface preparation and priming.
4. Problems involved when employing dissimilar metals.
5. Comparison of protective coatings such as:
(a) Grease.
(b) Oil-base paints.
(c) Varnishes with and without aluminum powder.
(d) Bituminous and asphalt paints, with and without aluminum powder.
(e) Lacquers.
6. Reasons for occasional excessive corrosion of rivets in boat hulls and pontoon bottoms.
7. Correlation of these various factors with varying exposure conditions such as alternate wetting and drying, constant immersion, exposure to or absence of sunlight, freezing, and thawing.
In addition to the above tests on structures, considerable work of allied nature has been done employing flat panels. Such tests have been conducted by Aluminum Company of America in the beforementioned Edgewater apparatus and in its laboratories at New Kensington, by the U. S. Navy at Norfolk, by the Naval Aircraft Factory at Philadelphia, by the Bureau of Standards and by various aircraft manufacturing concerns. Furthermore, throughout this period, constant contact by means of correspondence and periodic visits was maintained with manufacturers, operators, and repair stations, commercial and military, throughout the United States, including the Atlantic and Pacific Coasts and the U. S. Navy Station in Cuba. This latter locality is fairly repre-
106
Send for complete book
50 cents brings it
ALUMINUM AIRCRAFT

ALCOA ALUMINUM
THE ONE METAL THAT FLIES BEST

ALUMINUM COMPANY of AMERICA;
2482 Oliver Building, Pittsburgh, Pa.
Please send me "Aluminum in Aircraft."

*Name*_____
*Street and Number*_____
*City*_____ *State*_____
*Name of Company*_____
*Position*_____


WESTERN UNION CABLEGRAM
Floyd Bennett Field
N.Y. Municipal Airport
July 17, 1931.
Sperry Gyroscope Co., Inc.
Manhattan Bridge Plaza
Brooklyn, N. Y.
Gentlemen:
We can't say enough about the Sperry Horizon and Directional Gyro. Both instruments functioned perfectly throughout our flight around the world in the "WINNIE MAE OF OKLAHOMA".
We flew four straight hours at one time between Siberia and Nome without being able to see outside the ship, and our success in getting through was due to our implicit faith in these instruments.
It is our firm belief that the Sperry Horizon and Directional Gyro are two instruments that will help make scheduled transport flying safe in any kind of weather and we hope that we have been able, in a measure, to show and prove the present possibilities of instrument flying.
Very truly yours,
Wiley Post
Harold Gatty
WESTERN UNION CABLEGRAM
ADIOGRAM
WORLD WIDE WIRELESS
R.C.A. COMMUNICATIONS, INC.
Commercial Cable
FIVE
Epoch Making Flights
with
SPERRY INSTRUMENTS

DURING two months of 1931 five transoceanic flights have been made. All of them have attained more in distance and in surmounting of bad weather conditions than has ever heretofore been accomplished in the history of aviation.

Transoceanic flights of previous years have involved numerous failures and have for the most part been attempted only when weather conditions were ideal.

The most important difference in the equipment of transoceanic planes of this year over those of previous years is the addition of the Sperry Gyro-Horizon and Directional Gyro.

Descriptive pamphlet will be sent on request.

A DIVISION OF NORTH AMERICAN AVIATION INC

SPERRY GYROSCOPE CO., *Inc.*

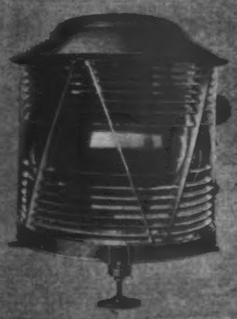
BROOKLYN — NEW YORK

THE SPERRY-AGA ROLL CALL

WILL YOUR AIRPORT BE ADDED TO THIS ROLL OF HONOR?

SPERRY-AGA
RECENT FLOODLIGHT INSTALLATIONS

Akron, Ohio, Municipal Airport
Floyd Bennett Field, New York Municipal Airport
New Haven, Connecticut, Municipal Airport
Atlanta, Georgia, Municipal Airport
Lambert-St. Louis Municipal Airport
Glenn H. Curtiss Airport, North Beach, Long Island
Corry Field, Pensacola, Florida
Saskatoon Airport, Saskatoon, Canada



SPERRY-AGA, 1000-mm., Arc and Incandescent Floodlight

SPERRY-AGA, dioptric lens, arc and incandescent, landing field floodlights most nearly approach daylight landing conditions, because they project more light on the ground and less light in the air than any other existing floodlighting system.

AMERICAN GAS ACCUMULATOR COMPANY

Airport Lighting Division · Exclusive Distributor for AGA, B.B.T., and SPERRY Airport and Airway Lighting Equipment

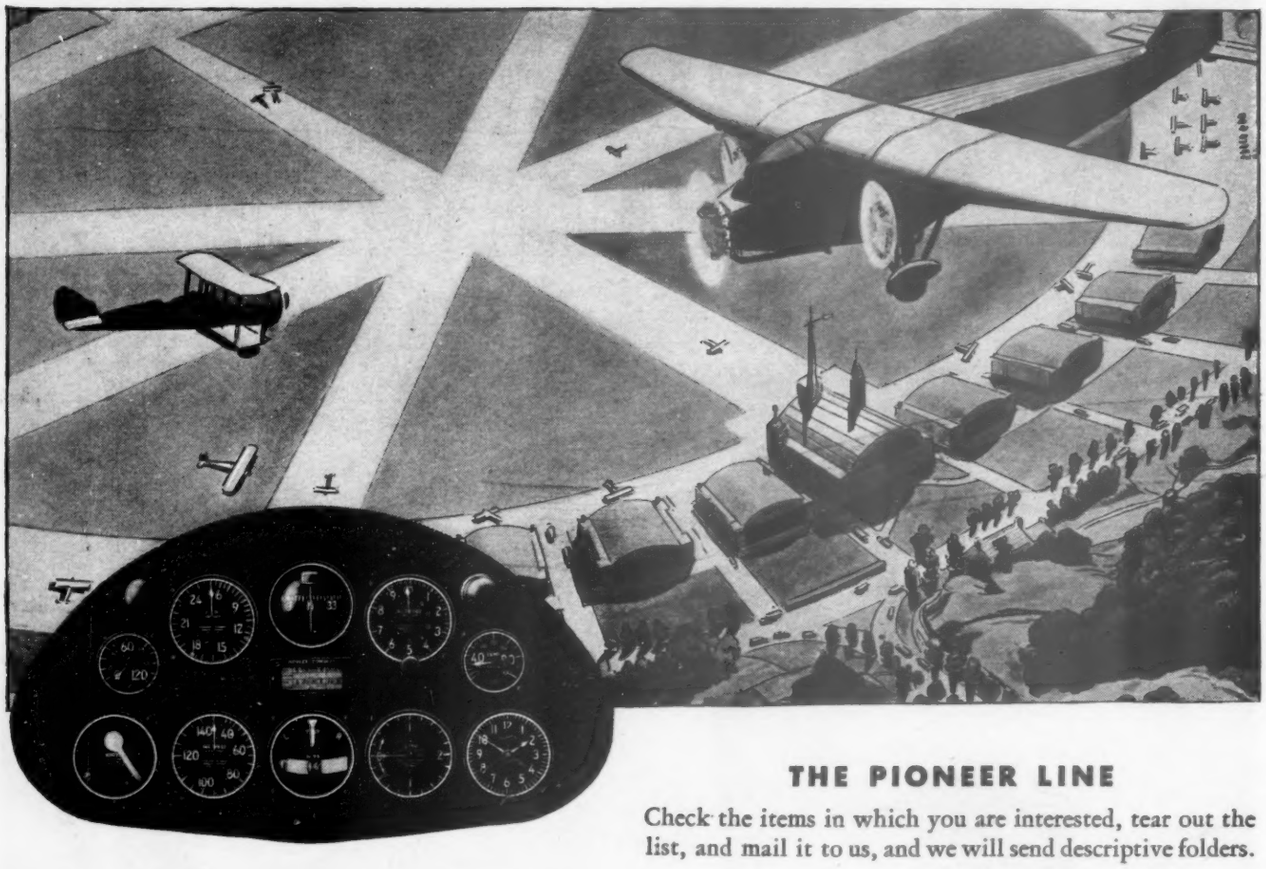
ELIZABETH, NEW JERSEY

West Coast Representative: Sperry Gyroscope Company, Inc.
Los Angeles · San Francisco · Seattle

AGA AIRPORT LIGHTING

AGA AIRPORT LIGHTING

YOU OWE IT TO YOUR PASSENGERS



Pioneer Instruments have been used on every famous American flight since 1919. They have been found trustworthy in carrying passengers safely over the thousands of miles of airways in this country and abroad. They have been found practical by 72 American airplane manufacturers.

If your plane is not completely equipped with Pioneer Instruments, ask for a Pioneer installation. You cannot be wrong in following the lead of the men who want the best equipment for planes they make and for planes they fly. Whether you fly a private plane or operate an air line, you owe it to your passengers to use Pioneer Instruments.

THE PIONEER LINE

Check the items in which you are interested, tear out the list, and mail it to us, and we will send descriptive folders.

Air Distance Recorder	Level Flight Indicator
Air Speed Indicator	Magneto Switches
Altimeter	Navigation Lights
Ammeter	Octant
Bank Indicator	Oil Pressure Gauge
Barometer	Pitch Indicator
Climb Indicator	Pitot Tube
Clock	Rheostat
Compass, Magnetic	Speed and Drift Meter
Flare, Parachute	Speed Timer
Flight Time Indicator	Sun Compass
Fuel Flow Meter	Switches
Fuel Level Gauge	Tachometer
Fuel Pressure Gauge	Terminal Blocks
Fuel Sight Gauge	Thermometer
Fuel Strainer	Turn Indicator
Hand Fuel Pump	Voltmeter
Landing Lights	Watches, Navigation

Pioneer Engineers will be pleased at any time to confer with you on your instrument equipment, and any special problems of installation which you may have.

PIONEER INSTRUMENT COMPANY

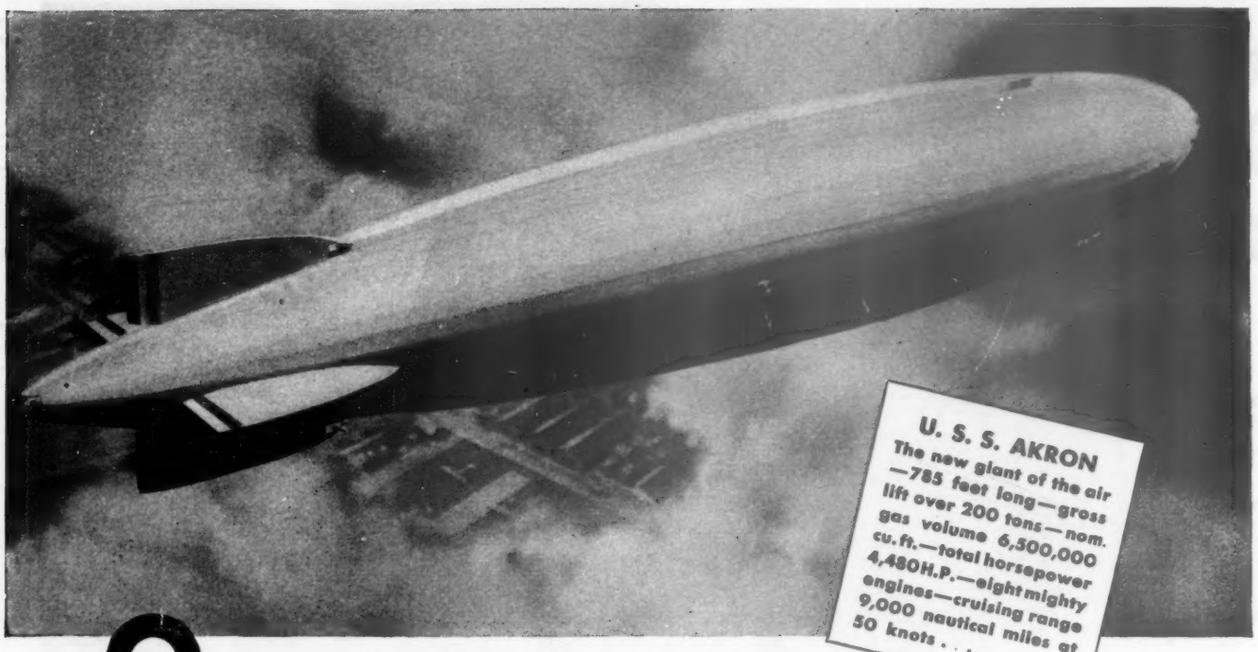
INCORPORATED · · · DIVISION OF BENDIX AVIATION CORPORATION

754 LEXINGTON AVENUE · · · BROOKLYN NEW YORK

205 FIRST NATIONAL BANK BUILDING, DEARBORN • BENDIX BUILDING, LOS ANGELES • 15 SPEAR ST., SAN FRANCISCO • 5214 W. 63RD ST CHICAGO • 527 SUSSEX ST. OTTAWA
STERNPLATZ 13 BERLIN-JOHANNISTHALL GERMANY • • GENERAL EUROPEAN REPRESENTATIVE, M. CALDERARA, 47 AVENUE DE BRIMONT CHATOU S & O. FRANCE

KINNER

THREE SIZES , ALL 5 CYLINDERS , 100 H.P. , 125 H.P. , 210 H.P.


U. S. S. AKRON
The new giant of the air —785 feet long—gross lift over 200 tons—nom. gas volume 6,500,000 cu. ft.—total horsepower 4,480 H.P.—eight mighty engines—cruising range 9,000 nautical miles at 50 knots . . .

8 WESTON TACHOMETERS ON THE U. S. S. AKRON

Model 545 INDICATOR — Mounted in a standard aircraft case used with instruments of the 3-inch group. Furnished with black dial with luminous markings and pointer.

Light weight and rugged construction—vital to safe, efficient flight—were major factors in building the U. S. S. Akron.

Weston Tachometers met these specifications. Sturdy, rugged, compact, and trouble-free—they consist of but two units:—a light D.C. magneto-generator and an indicator calibrated in R.P.M. They bring engine speeds directly to the instrument panel. Operating electrically, they eliminate flexible drive shafts—weight and trouble. Complete shielding prevents interference with the magnetic compass and radio.

Made especially for aircraft use, designed by Weston engineers who developed the standard speed indicating equipment in the railway, marine, and industrial fields, Weston Tachometers are invaluable in modern flying.

FEATURES OF WESTON TACHOMETERS

1. Accurate, steady, dependable indications.
2. Light weight.
3. Simplicity and ease of installation.
4. Practical freedom from all maintenance.
5. Complete elimination of troublesome, flexible drive shafts.
6. Unaffected by temperature changes.
7. Indicators give 270° deflection over 5½-inch scale.
8. Indications unaffected by banking, etc.
9. Fully shielded to prevent interference with magnetic compass or radio.

Model 544, MAGNETO-GENERATOR — weighs only 1 pound 5 ounces. Screws directly on engine SAE tachometer outlet. Generates a voltage, directly proportional to driven speed, which is carried by small wires to indicator on cockpit panel.

WESTON

ELECTRICAL INSTRUMENT CORPORATION

616 FRELINGHUYSEN AVENUE • • • NEWARK, N. J.

Reliability

Safety, comfort, "on-time" transportation—the demand of the airline passenger today. **Dependable performance with an economy that insures legitimate profit**—the need of the airline management. No other plane in the world has ever combined all these requirements as they are combined in the big 15-place Bellanca Airbus. **This single-engined monoplane type,** designed by Bellanca and built as only Bellanca can build, has proved itself in service a worthy descendant of all the Bellancas that have performed* so brilliantly in the great reliability tests of history.

BELLANCA AIRBUS

Safety is attained by Bellanca-perfected flying qualities, balanced control and rugged construction; moreover, safety in the single-engined plane is attested by all of aviation history.

Comfort is achieved in the smooth steadiness of the plane; the well-cushioned seats; and the quiet of its single power plant, mounted far in front of the cabin.

Cruising Speed is 120 miles an hour, and range is 600 miles.

Payload is *twice* that of other single-engined transports of similar horsepower; 14 passengers and 500 lbs. of baggage; or 11 passengers and 1,075 lbs. of baggage, freight and mail.

Operating Cost is *half* that of multi-engined airplanes of similar load capacity; the single Cyclone (or Hornet) engine being economical and utterly reliable in operation.

The result of these facts is that the Bellanca Airbus earning capacity is far beyond that of any other airplane

***BELLANCA MONOPLANES HAVE WON**

National Air Race Efficiency Contests nine times since 1923.

American Endurance Record three times since 1927.

World's Endurance Record twice since 1927, Pilots Lees and Brossy establishing same at 84 hrs. 33 min., May, 1931, in their Packard-Diesel-powered Bellanca Pacemaker.

Ford Reliability Tour (single-engined cabin plane class) twice since 1929.

World's Long Distance Record in 1927, over 4,000 miles non-stop from U. S. to Germany; in 1931, New York to Istanbul, Turkey, 5,000 miles non-stop.

Commercial Airplane Altitude Record in 1930, 30,453 ft., by Capt. George Haldeman.

Transatlantic Flights — in "The Columbia," twice across; also, non-stop to Bermuda and return. In "The Pathfinder," from Maine to Spain. In "The Liberty," non-stop to Germany. In the "Cape Cod," from New York to Turkey. In the "Miss Veedol," from New York to Wales, England.

All Bellanca Aircraft Manufactured Under Department of Commerce Approved Type Certificate

BELLANCA AIRCRAFT CORPORATION

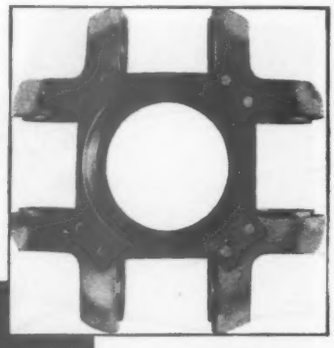
New Castle, Delaware — Chrysler Building, New York

Bellanca Aircraft of Canada, Ltd., Montreal

BELLANCA

The AUTOGIRO

© 1931, Autogiro Co. of America



ABOVE: Nickel-Chromium Steel rotor hub of Autogiro, mfd. by AUTOGIRO SPECIALTIES CO., Philadelphia, Pa. LOWER LEFT: Nickel Alloy Steel spar end fitting used in Autogiro. (Forgings by The Midvale Company). LEFT: Autogiro mfd. by PITCAIRN AIRCRAFT, INC., Willow Grove, Pa.

...*with* NICKEL STEEL *parts introduces a new era of air travel*

Marking a new development in aircraft design, the Autogiro embodies distinctive safety features which promise to revolutionize aeronautical construction. One of the most important parts of the Autogiro is the rotor with its horizontal revolving blades—a unique feature permitting the machine to hover almost stationary and to decend almost vertically.

Nickel Alloy Steel S.A.E. 3435 is specified by the Autogiro Specialties Company for the rotor hub and fittings. This hub must be especially strong and tough, since in flight it must withstand the centrifugal and torsional forces incident to the rotation of the blades, and must support the entire weight of the machine. Nickel Alloy Steels are also used in most of the highly stressed parts of the engine which powers the Autogiro, and Aerol landing gear struts with Nickel Steel cylinders are standard equipment.

Leading aviation engineers specify Nickel Alloy Steel wherever toughness, safety and dependability are essential. You are invited to consult with us regarding your problems in selecting Nickel Alloy Steels.

Nickel
ALLOY STEEL
PERFORMS BETTER LONGER

THE NICKEL

Send for our publication, "The Curtiss and Wright Engines and Their Use of Nickel Alloy Steel"

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

Miners, refiners and rollers of Nickel. Sole producers of Monel Metal

THE *DRONE'S* THE THING!

To most folks a droning sound is just plain monotonous. But to the airplane Pilot—ah, that's different. The drone's the thing!

Monotonous or not the engine's drone is a soul satisfying sort of sound.

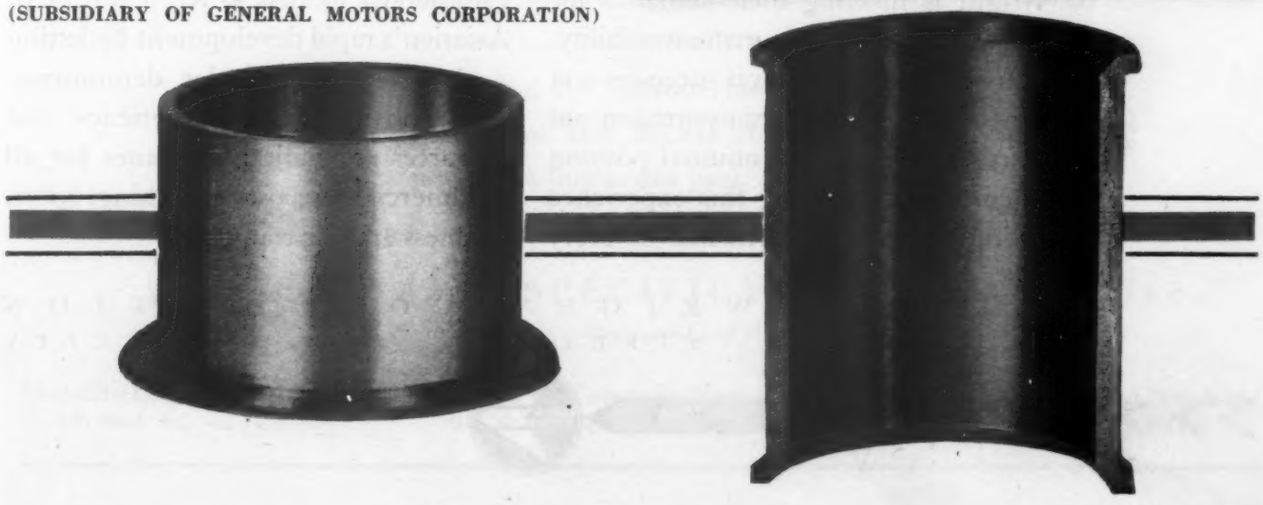
ALLISON STEEL BACK BRONZE LINED BEARINGS assure the uninterrupted service demanded by present day standards of sustained flight.

Produced under the most exacting laboratory methods they continue to merit the confidence reposed in them by the builders of the world's most powerful and dependable engines.

ALLISON
ENGINEERING CO.

INDIANAPOLIS, IND.

(SUBSIDIARY OF GENERAL MOTORS CORPORATION)



All Aviation benefits from *Curtiss-Wright* military achievements

Curtiss-Wright is supplying *all* types of planes to the Army and Navy Air Services. Building to rigid, strategic requirements of the Bureaus, Curtiss-Wright is meeting their demands for speed, stability and maneuverability. ◉ Its Military and Naval successes and penetrating study of transportation put Curtiss-Wright in the unusual position of constantly applying this experience to improve the performance of every plane it produces. That is how Curtiss-Wright is constantly adding speed, increasing useful load and obtaining greater economy of operation in its commercial models. ◉ Keep abreast of Aviation's rapid development by letting a Curtiss-Wright dealer demonstrate how Curtiss-Wright experience and resources are built into planes for all commercial purposes—training, sport, business and air transport.

CURTISS-WRIGHT CORPORATION
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From New York *to* Turkey

STANAVO

Contributes to Another World's Record

Setting a record from the very take-off, two undaunted aviators recently left Floyd Bennett Field, New York, and headed their plane towards Istanbul, Turkey. Their Bellanca airplane, powered by a Wright Whirlwind engine, had lifted the greatest load ever flown with an engine of 300 horse-power.

Forty-nine hours and twenty minutes later these flyers landed at Istanbul, Turkey—the first eastward non-stop transatlantic aviators since 1927 to reach their announced destination. 5,011 miles had been covered to set a new world's non-stop distance record.

Among the various factors contributing to the success of this flight, Stanavo Aviation Gasoline played an important part.

STANAVO SPECIFICATION BOARD, Inc.

Organized and Maintained by

Standard Oil Co. of California
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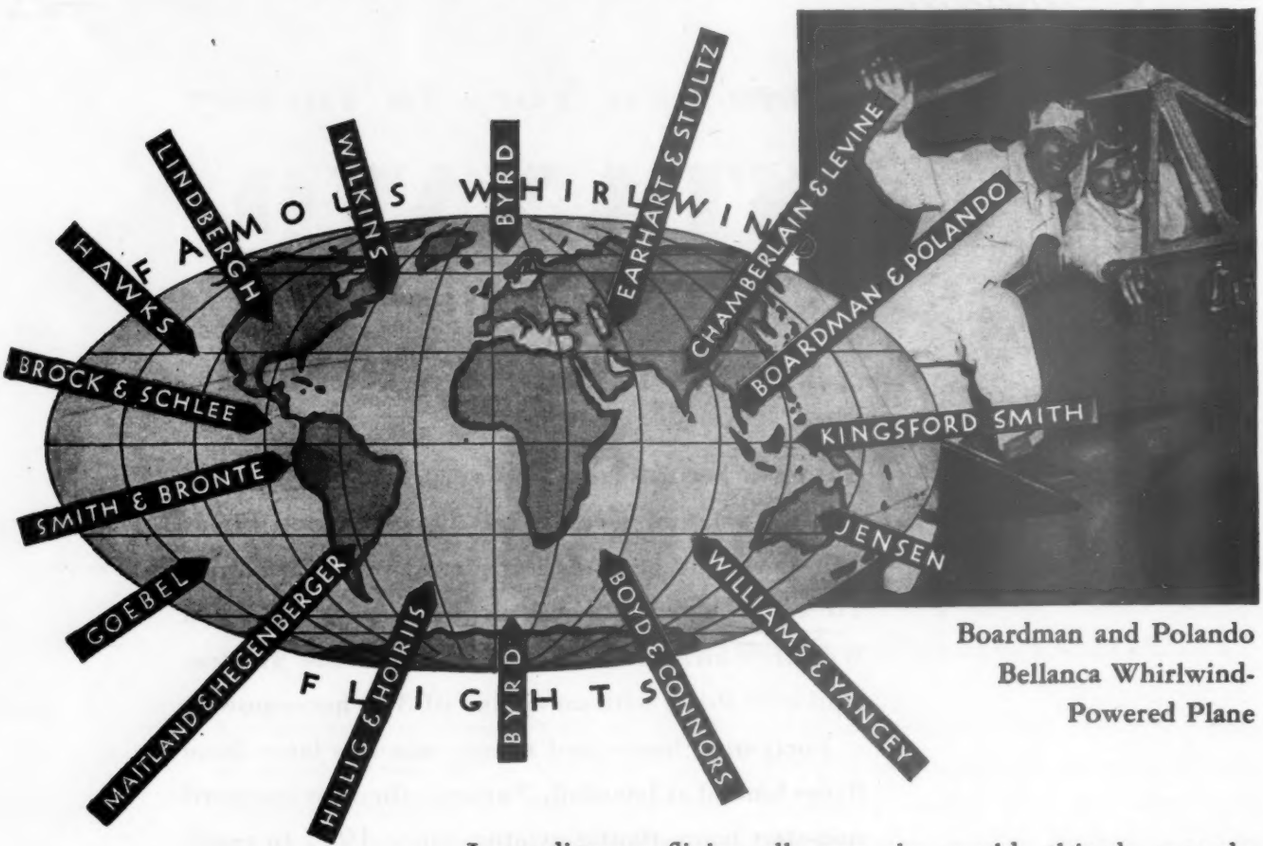
WRIGHT ENGINE FLIES TO ANOTHER WORLD'S RECORD

BOARDMAN *and* POLANDO, N. Y. *to* ISTANBUL

5040 MILES *in* 49½ HOURS



Boardman and Polando Bellanca Whirlwind-Powered Plane

Long-distance flights all over the world, altitude records, endurance tests with and without refueling, speed marks—Wright Engines have powered more famous flights than all other engines combined. Consider how much is revealed about engine reliability by these famous Whirlwind-powered flights. The technical reasons are highly interesting and are found in Wright design, materials and workmanship. But, the point to remember when designing planes is that Wright Engines alone combine the features essential for spectacular hops and for steady day-to-day sport, business and commercial flying.

WRIGHT
AIRCRAFT ENGINES

WRIGHT
AERONAUTICAL CORPORATION
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A DIVISION OF CURTISS-WRIGHT CORPORATION

CONQUEROR · CYCLONE

Is IGNITION NOISE spoiling your radio reception?

Here is a new spark plug that will eliminate it completely

YOU can stop the noises that drown out weather broadcasts and beacon signals by installing Hahn Radio Shielded Spark Plugs in conjunction with a shielded harness and shielded magnetos.

Hahn Plugs banish every trace of interference from short wave or long wave reception completely. So completely, in fact, that the leading manufacturers of aviation radios fly Hahn Plugs in their demonstration ships.

Shielding the ignition system will not impair your engine's performance if Hahn Plugs are used. They will not preignite in a hot engine... nor foul in a cold one. They require servicing only every 100 flying hours.

The Hahn Plug is insulated with mica. The large area of the Hahn electrodes prevents burning away and assures a constant gap. In air transport service Hahn Plugs average 500 flying hours . . . some have been flown for over 800 hours. Considered from the standpoint of cost per hour of flight and cost of maintenance required, you will find them the lowest in price.

May we send you a folder that describes all the advantages of the Hahn Plug? There will be no obligation, of course, and it will materially help you to solve your shielding problems.

Walter Kidde & Company, Inc.
140 Cedar Street
New York

HAHN *Radio-Shielded Spark* PLUG

"The risk we take" is less with PENNZOIL *costs less per hour*

Ask for PENNZOIL—
Not just "Pennsylvania Oil"

Pennzoil can be depended on for absolute safety. Lindbergh, Chamberlain, Goebel, Kelly, McCready, Doolittle and dozens of others have depended on Pennzoil Aircraft Oils when motor failure meant death. The big air lines and good operators everywhere depend on it to reduce motor failure to the minimum.

In addition, Pennzoil increases the period between overhauls. It gives you many extra flying hours with every refill. It costs less per flying hour.

The PENNZOIL COMPANY: Executive Offices and Refinery: Oil City, Pa.
Division Offices: New York, Chicago, Los Angeles
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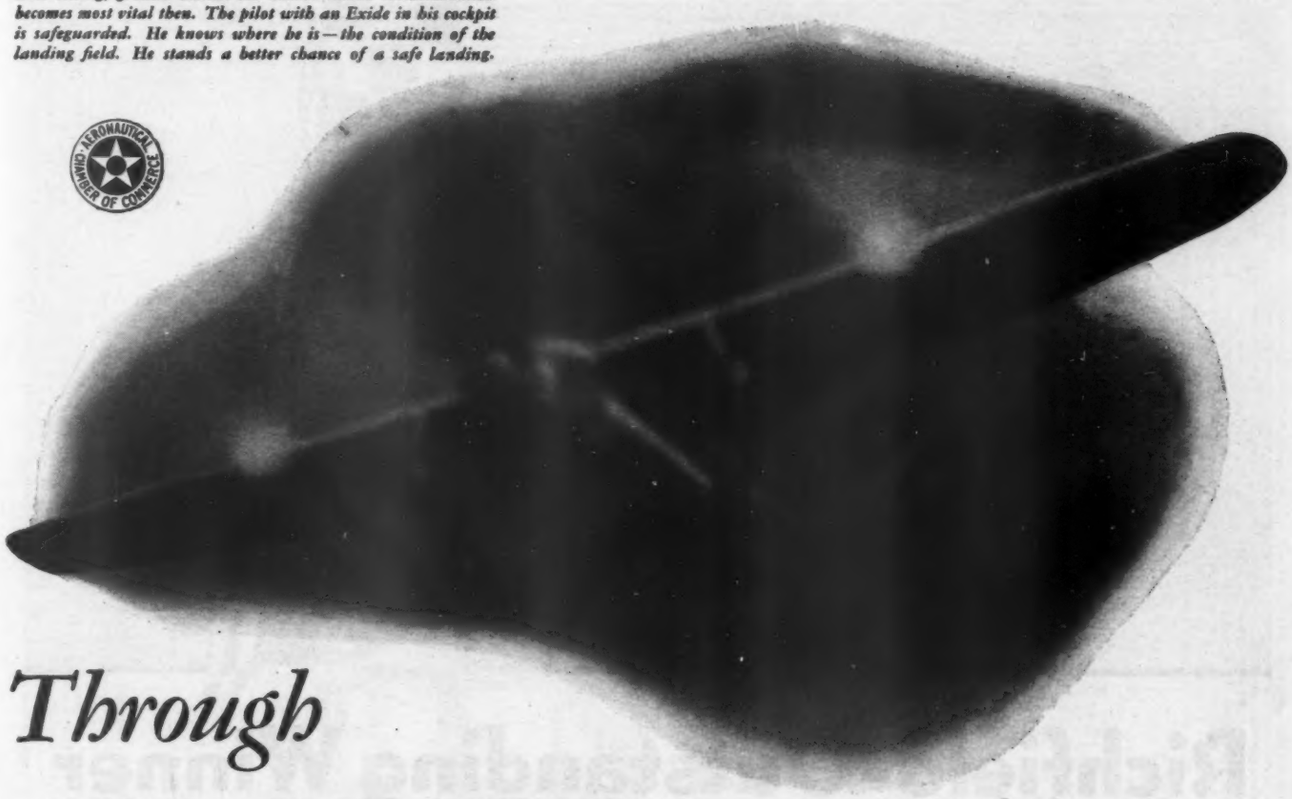
SAFE LUBRICATION

PENNZOIL is made by the famous Pennzoil Process from 100% pure Pennsylvania crude and nothing else.

PERMIT NO. 2—PENNSYLVANIA GRADE CRUDE OIL ASS'N

Low ceiling, ground blotted out below. Radio communication becomes most vital then. The pilot with an Exide in his cockpit is safeguarded. He knows where he is—the condition of the landing field. He stands a better chance of a safe landing.



Through "SOUP" a Mile Thick . . . to a Safe Landing

Here's a battery that was made to fly. This Exide Aircraft Battery is light-weight—compact—safe.

Exide
AIRCRAFT
BATTERIES

Pilots fly with confidence as dependable Exides keep radio communications alive

"HEAVY FOG" . . . "ceiling 400 feet"..."You're directly overhead," come the messages to the pilot winging above the fog bank. A few minutes later he's made a safe landing.

Exide Aircraft Batteries help make radio communication certain—and do other jobs just as dependably. They furnish current for landing, navigation and instrument lights—starting and ignition. Exides have proved their worth over thousands of miles of sky lanes. They are so designed that the electrolyte will not spill—even in the hardest kind of flying service. Their construction is compact and light-weight. Three very desirable flying features. But just a few of the reasons why they are preferred.

Ask your friends about Exide reliability. Or write today for further information about the many types of Exide Aircraft Batteries. One-seater "mono" or transcontinental air liner —there's an Exide to fill the bill.

Contractors to the U. S. Army and Navy

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

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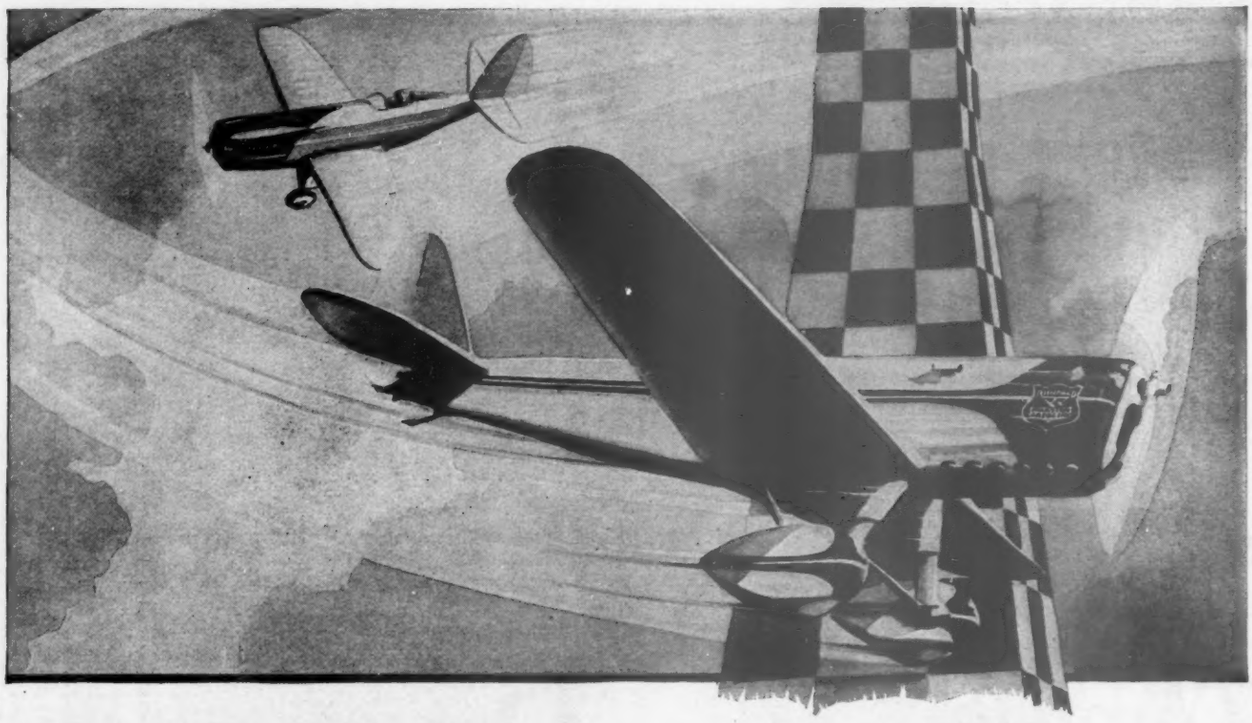


Richfield-Outstanding Winner at NATIONAL AIR RACES!

1928—Winner of the Class A Transcontinental, Class C Transcontinental, Class A California derbies and Transcontinental non-stop race...*4 of the 6 major events staged!*

1929—Winner Oakland to Cleveland and Pittsburg to Cleveland derbies. Also...7 closed course events!

1930—Winner more victories in non-stop, derbies and closed course events *than all other gasolines combined*...a record of 42 out of 67 events!

Here is conclusive, undeniable proof of quality ...dramatic proof that Richfield is unequalled for power, speed and dependability. No other gasoline has even remotely approached this record since the inception of Aviation's annual classic...the National Air Races!

This year...Richfield offers you COMBAT Aviation Gasoline. A new name...and a new high quality that surpasses "fighting grade" specifications as well as the most rigid requirements of commercial flying.

COMBAT is the fightin'est gasoline ever put in a motor...at the price of ordinary gasoline. Available at important airports both east and west of the Mississippi.

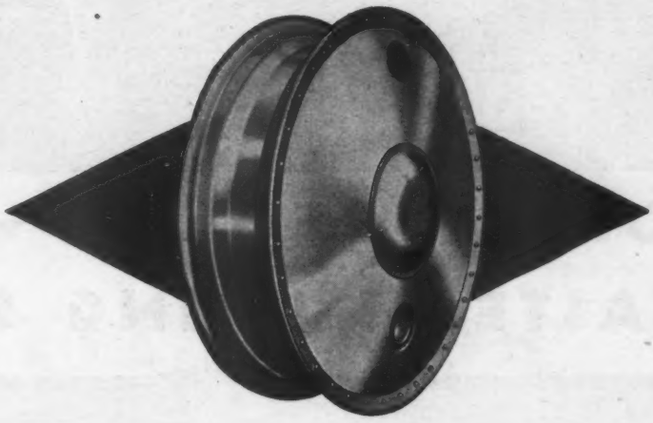
Combat Aviation Gasoline and Combat Aviation Oil will be available at 1931 National Air Races at Cleveland

COMBAT

Richfield's Aviation

GASOLINE

RICHFIELD OIL COMPANY ✣ LOS ANGELES ✣ NEW YORK CITY



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Airplane Wheels and Brakes

BENDIX NEW ROLLER-BEARING WHEELS
for Standard Tires

BENDIX NEW ROLLER-BEARING WHEELS
for Low Pressure Tires

Both wheel and brake are the last word in scientific development and precision manufacture; maximum efficiency combined with minimum weight and size. *Built to U. S. Army Air Corps, U. S. Navy, S. A. E., and Tire and Rim Association Standards.*

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SOUTH BEND, INDIANA
(Subsidiary of Bendix Aviation Corporation)

BENDIX 4 BRAKES

FOR SAFETY

FULLY PROTECTED BY PATENTS AND APPLICATIONS IN U. S. AND ABROAD

Air Mail Saves Time

SPEED YOUR TAKE-OFFS with this FASTER FUELING SERVICE

G&B AEROPIT

Here it is on the job in Argentina. The Nyrba Co. of Buenos Aires chose it for its faster, more economical type of service—and its low cost.

HERE'S THE BEST INSURANCE AGAINST MOTOR TROUBLE DUE TO WATER OR SEDIMENT IN GAS

G & B FILTER FUNNEL *—representing the best ideas of leading commercial transport operators.*

Try a G & B Filter Funnel just once, and never again will you use the old chamois or felt makeshifts. Does a thorough job *quickly*. Instantly reveals water in gas. Takes out all dirt, sand, lint, rust or sediment at 26-gallons-a-minute delivery. Flaring, reinforced legs keep it steady. Has quick shut-off valve at top. Swinging discharge tube is capped when not in use—kept clean and out of harm's way. Any operator or airport can afford the Filter Funnel. Send for details.

● A transport company that can't offer fast schedules is lost. Passengers won't pay their money for delays due to slow and inadequate fueling service. That's why more and more airports are putting in Gilbert & Barker Aeropits. Here's a fueling service that works fast: in actual test has served 232 gallons in 9 minutes. Lessens field congestion, too. Supplies gas the instant it is wanted, and where wanted.

● The Aeropit lies flush with the ground, thus decreasing field and fire hazards. Two or three planes can taxi up to it at a time. One man can operate it—you simply snap on the motor switch, pull out the hose, and meter away. It's the safer, speedier, more convenient way. G&B Aeropits are now used at Boston, Mass., Newark, N. J., Salt Lake City, Utah, Burbank, Calif., Le Bourget, France, Croyden, England, and many other airports here and abroad. Send for free bulletin.

GILBERT AND BARKER
MANUFACTURING COMPANY
SPRINGFIELD, MASS., U. S. A.
GASOLINE AND OIL FUELING EQUIPMENT

The World that

NAVY

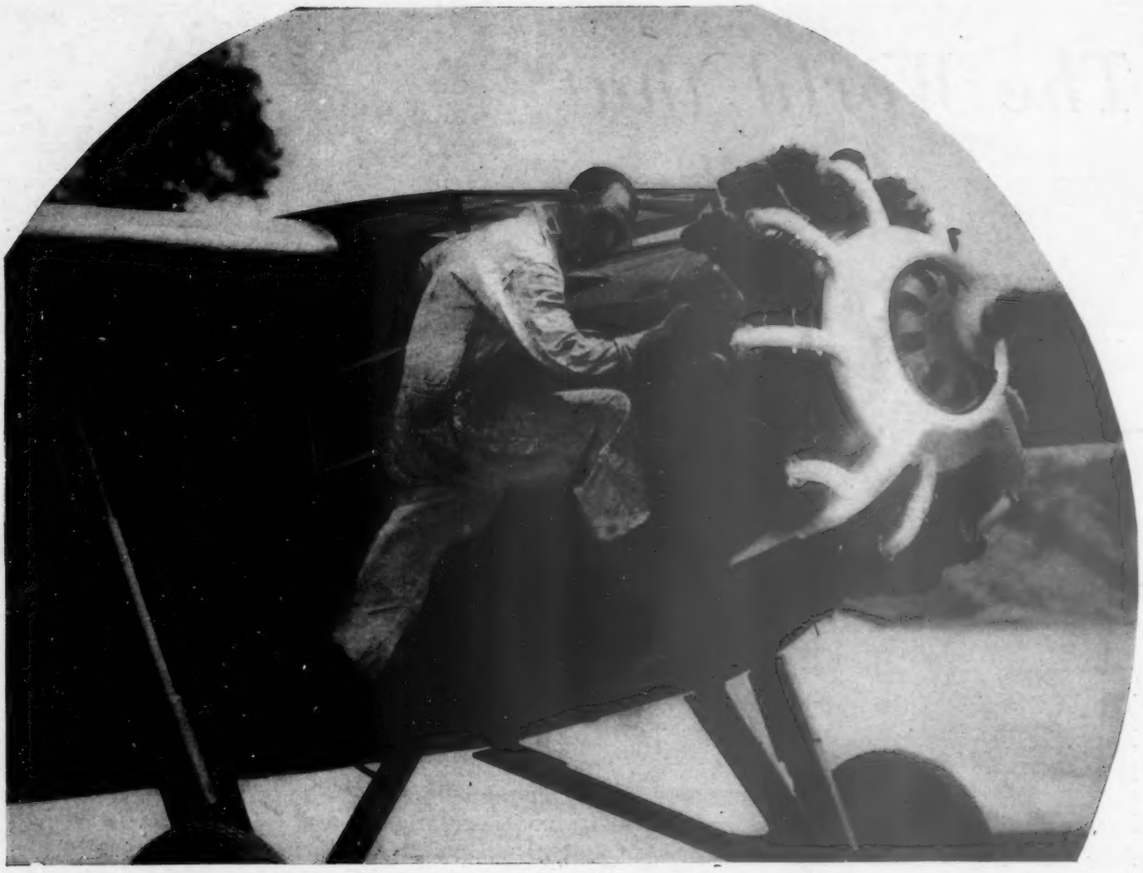
CORSAIRS *See*

Vought *Corsairs* see the world with the Navy. For *Corsairs* are always with the fleet—wherever it may go.

In service with the aircraft carriers, *Corsairs* take off from steel decks—which are often far from steady runways—and land into relentless arresting gear. *Corsairs* are catapulted from the battleships and cruisers. They land in rough and choppy seas and are hoisted aboard by cranes. Service like this demands stamina and handling qualities far beyond the requirements of ordinary flying. And the way the *Corsair* meets such demands has made it a standard observation plane of the U. S. Navy.

Combine the structural strength of the *Corsair* with its exceptional speed range and ease of handling and you have a plane ideally suited for fast executive transport and private flying. Chance Vought Corporation. Division of United Aircraft & Transport Corporation. East Hartford, Connecticut. Export representative: United Aircraft Exports, Inc., 230 Park Avenue, New York, N. Y.

CHANCE VOUGHT CORPORATION



"She's running sweet!"

YOU'LL SAY, "She's running sweet," when your motor is fueled with Socony Aviation Gasoline and lubricated with Socony De-waxed Motor Oil. This combination, air-tailored by our own aviation experts and tested in our own Test Plane, will give your motor as many r. p. m.'s as she was built to deliver. Try these Socony products next time and hear "a sweet-running motor."

SOCONY

AVIATION GASOLINE

SOCONY DE-WAXED MOTOR OIL

STANDARD OIL COMPANY OF NEW YORK

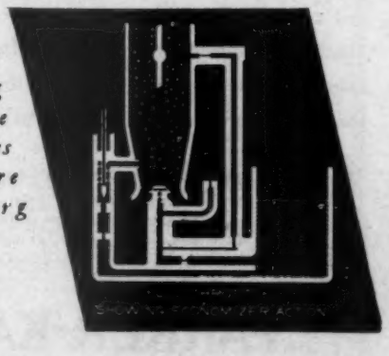
POWER
AT high ALTITUDES

Thanks to the *mixture control* on all Stromberg Aircraft Carburetors, power at high altitudes is no longer a thing unattainable.

This mixture control, operated handily from the dash board, enables the pilot to compensate fully for the change in fuel mixture that takes place as the plane climbs higher. With this controlled increase or decrease in the amount of fuel entering the carburetor, naturally the engine's power is not cut down in proportion to atmospheric density.

Solving this problem is but one of the ways Stromberg engineers have aided in the development of aircraft engines. Theirs is an experience of 22 years. Perhaps they can help you with your own carburetion problems. Inquiries are invited.

Over 95 per cent of the Aircraft engines being built in the United States today are Stromberg equipped.



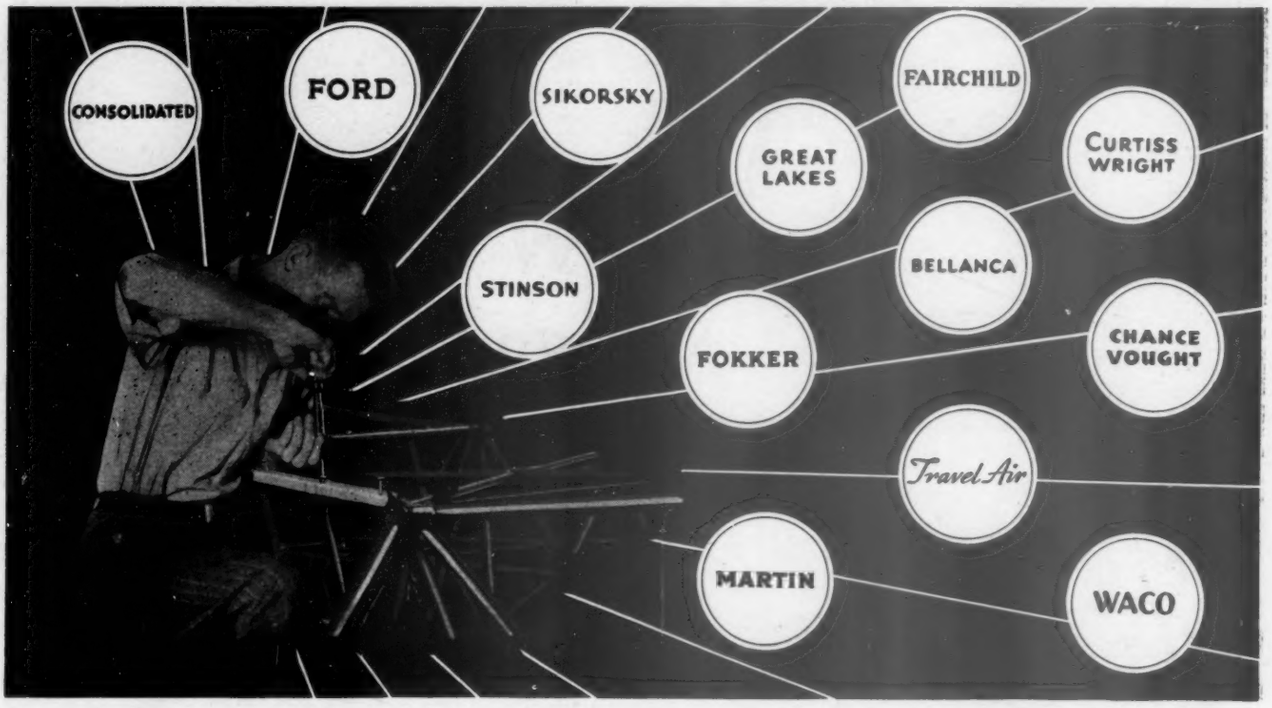
STROMBERG CARBURETORS

BENDIX STROMBERG CARBURETOR COMPANY

«SUBSIDIARY OF BENDIX AVIATION CORPORATION»

701 BENDIX DRIVE • SOUTH BEND, INDIANA

THE AVIATION INDUSTRY CANNOT SACRIFICE ASSEMBLY SECURITY TO GAIN ECONOMY



Experience and tests prove that Self-tapping Screws provide both

When a new airplane is rolled out of the factory, the hundreds of fastenings in the plane are just details. But they take on great importance as the plane roars up into the clouds. Then, each fastening is either dependable or a real menace.

Leading airplane manufacturers have found that they need not compromise with assembly security in order to gain production speed and economy. They obtain all three by using Self-tapping Screws for metal assemblies. Noted as the easiest and cheapest means of making metallic fastenings, these unique Screws also provide exceptional security. Scientific tests prove that fastenings made with them actually hold better than either machine screws or bolts and nuts under tension, shear and vibration stresses.

If your product involves metal assemblies you will profit by investigating Self-tapping Screws. Our Assembly Engineers will tell you honestly whether or not you can use the Screws to advantage. To obtain this FREE service, attach a description of one or more assemblies to the coupon, which also brings the interesting booklets shown below.

Type "Z" Hardened Self-tapping Sheet Metal Screws
For joining and making fastenings to sheet metal up to six gauge; also aluminum, die castings, Bakelite, etc. Simply turn Screw into drilled, pierced or molded hole. It forms a thread in the material as it is turned in. Can be removed and replaced.

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This type of Self-tapping Screw is used for making permanent fastenings to iron, brass and aluminum castings, steel, Bakelite, Durez, etc. Just hammer the Screw into a drilled or molded hole. It forms a thread in the material as it is driven.

PARKER-KALON *Hardened* Self-tapping Screws

PAT. IN U. S. AND FOREIGN COUNTRIES

← 14 Unbiased Reports on Savings ---------- Scientists Explain Fastening Security →

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Send me free booklets on the Security and Economy of assemblies made with Self-tapping Screws.

Name and Co.----------

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of the "CATERPILLAR CLUB"

Oil-caused grief often shows up* AFTER *it's too late to do anything but bail out and trust to your 'chute.

Gulfpride Oils are good insurance against forced membership in the Caterpillars.

Look into the facts: You'll find Gulfpride Oils show a remarkably flat viscosity-temperature curve. That's proof of the way they hold their body under high temperature operating conditions. Yet they never become objectionably stiff and tacky at low starting temperatures.

Your tachometer will show you a smoother, freer-running motor with Gulfpride, assurance of greater power and lift when you "give her the gun" in a sudden emergency.

Compare Gulfpride Oils to the next best Paraffin Base oil you can obtain. The Conradson test will show you that Gulfpride of comparable viscosity forms *less than a fifth as much carbon!*

If you've been hunting the best lubricant ...the oil that assures most air hours...you'll find it in Gulfpride.

Get* FREE *Book

The Gulf Aviation Atlas is complete with historical maps, records and data. Free to licensed pilots, licensed mechanics, students in recognized flying schools and all those associated with the Aviation Industry. Just drop a post card to Lubricating Department, Gulf Refining Company, General Sales Offices, Pittsburgh, Pa., U. S. A.

GULF

Gulfpride Oil

MORE AIR HOURS

Gulfpride Oil is 100% paraffin base mineral oil refined by the costly Aluminum Chloride method. Exclusive to Gulfpride. Gulfpride Oil exhibits a relatively flat viscosity-temperature curve; high flash and fire values, and low pour tests.

Gulfpride Oil holds its body exceptionally well at high operating temperatures. It is highly resistant to oxidation and emulsifying action.

Gulfpride Oil is made in five viscosities: 75-100-120-150 and 200 at 210°F, providing a superior lubricant for all types of aircraft motors, under all operating conditions.

Ask for Gulfpride Oil and you'll never be grounded because of oil-caused trouble.

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For more *Speed* and *Less Fuel*

Brace Aircraft with *Hartshorn* TIE RODS

The non-stretching, strong streamline tie rods perfected by Stewart Hartshorn Co. offer little wind resistance. That increases speed and reduces fuel consumption. They won't stretch! That cuts "follow up" and lining-up costs.

Many of the most famous aircraft in aviation history have been braced externally with Hartshorn Streamline Tie Rods.

Hartshorn Square Section Tie Rods speed assembly time, can be tightened from any point along the length of the rod and make immediately visible any torsional strain. These flat-faced rods can be made fast at intersections.

Brace every plane you build or fly with

Hartshorn Est. 1860 AIRCRAFT TIE RODS

STEWART HARTSHORN CO.
250 Fifth Avenue New York, N. Y.

Welding eight steel tubes to one point. Photograph by courtesy of the Stinson Aircraft Corporation and World's Work.

A CHAIN IS AS STRONG . .

A CHAIN is as strong as its weakest link goes an old saying. In airplane building, as in chain forging, high quality materials are of paramount importance.

We are called upon by leading airplane manufacturers, to supply all or part of their seamless steel tubing requirements. That this confidence is not misplaced is evidenced by the fact that The Ohio Seamless Tube Company long has been producer of the largest variety of seamless steel tubing known to industry.

Due to SHELBY expert workmanship, we can meet your needs in tubing, made from any steel . . . plain carbon, Toncan, Nitralloy or special alloys . . . that meet the stringent government specifications.

Consult our steel tubing specialists. They will be glad to help you solve any steel tubing problem you may have.

The OHIO SEAMLESS TUBE CO.
COLD DRAWN SEAMLESS STEEL TUBING
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FORMICA
CONTROL PULLEYS
in 3 TYPES

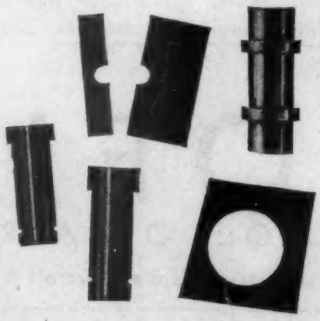
FORMICA control pulleys for aeroplanes are made in three types for different requirements. There are bearings of bronze impregnated with graphite which require no lubrication; ball bearing pulleys and roller bearing pulleys.

For the latter, lubrication is available which will operate satisfactorily over extreme ranges of temperature.

High grade bearings with ability to resist corrosion in salt spray are provided. The material of the pulley itself wears the cable less, and is insulation against sparks caused by static.

FAIR LEAD BUSHINGS

These bushings are made in various types according to specification. They are as strong approximately as cast iron but lighter than aluminum. Their dimensions are stable. They put a minimum of wear on the cables. Formica cabin lining in 20 colors is very light and attractive.



THE FORMICA INSULATION COMPANY
4622 Spring Grove Avenue, Cincinnati, O.

FORMICA

You'll go
FARTHER FASTER
with

BOEING
TRAINING!

WHEN beginners or veteran pilots have earned their Boeing diplomas, they can face the future with assurance.

Everything about Boeing School training points to one aim: Its graduates must be the best trained, most practical candidates available whenever the industry needs responsible men. A substantial number now included in the personnel of Boeing Air Transport, Pacific Air Transport, National Air Transport and other subsidiaries of United Aircraft and Transport Corporation—as well as in other companies—is a testimonial to the acceptance of these graduates by the industry.

Because of this goal, Boeing maintains the nation's best-equipped aeronautical school, in a location ideal for year-around flying. It offers the broadest courses, intensively taught (for instance. Master Pilot graduates have flown 204 hours—154 solo, 50 dual—in five types of planes, and have had 924 hours of ground school instruction).

The completeness of a Boeing School background gives you special recognition in the industry. It explains why Boeing Master Pilots, Transport Pilots, Special Master Pilots, and Master Mechanics find responsible positions awaiting them. Investigate this unusual school. Fall enrollment begins October 5th. Send the coupon below today.

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SCHOOL OF AERONAUTICS

Subsidiary of United Aircraft & Transport Corp.

BOEING SCHOOL OF AERONAUTICS
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Gentlemen: I am interested in

☐ Private Pilot
☐ Limited Commercial Pilot
☐ Transport Pilot
☐ Boeing Master Pilot
☐ Boeing Master Mechanic
☐ Special Master Pilot (For Transport Pilots)

Name_____ Age_____

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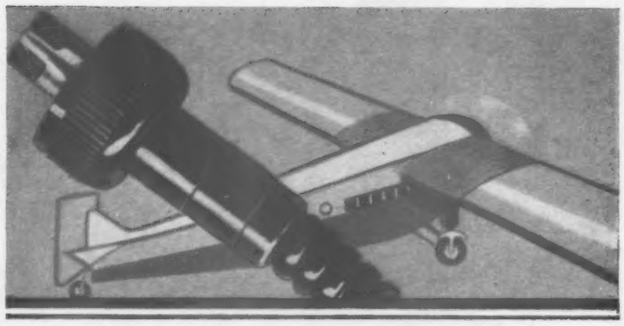

S. S. WHITE
FLEXIBLE SHAFTS
in the AVIATION Industry

The use of S. S. WHITE Flexible Shafts in the Aviation Industry has grown to substantial proportions. And as in the automotive, machine tool, and other industries in which they have been extensively used for many years, S. S. WHITE Shafts have won preference by their superior quality and unfailing reliability.

From the beginning of aviation, S. S. WHITE Flexible Shafts have been performing the important function of driving the tachometers in most of the aircraft in service. Today they are also used as the means of providing sensitive remote control in the leading makes of Aircraft Radio Receivers. They are also incorporated in other aircraft equipment such as gyroscopic stabilizers, magneto compasses and in fact in all equipment in the industry in which flexible shafts are used.

More than 60 years of pioneering and development have placed S. S. WHITE Shafts in a class by themselves for quality and dependability.

The wide range of sizes and physical characteristics in which S. S. WHITE Shafts are made, covers the requirements of practically any application. Complete data on shafts for tachometer, radio, and any other application will be furnished on request. Competent and experienced engineering cooperation is also offered for working out specific applications.

Address inquiries to

The S.S.WHITE Dental Mfg.Co.
INDUSTRIAL DIVISION

152-4 West 42nd St.
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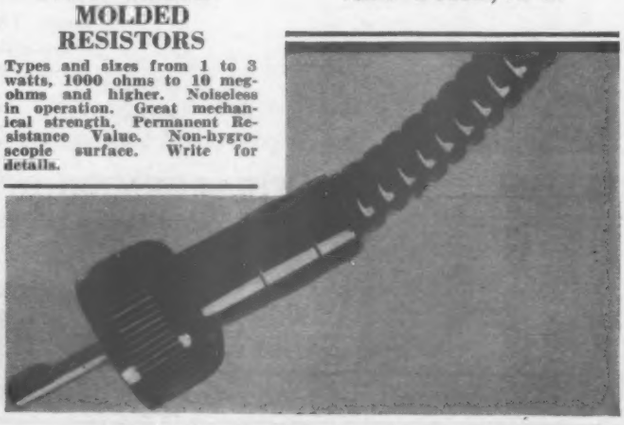
Makers also of
S. S. WHITE MOLDED RESISTORS

Types and sizes from 1 to 3 watts, 1000 ohms to 10 megohms and higher. Noiseless in operation. Great mechanical strength. Permanent Resistance Value. Non-hygroscopic surface. Write for details.



MILITARY STAMINA
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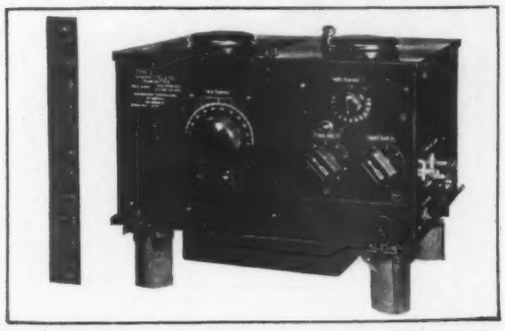
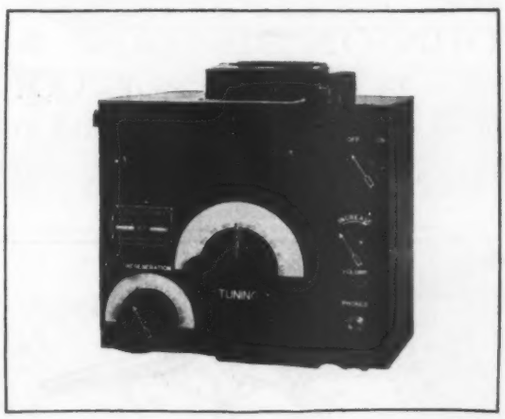


Type B Radiophone and telegraph transmitter for mounting anywhere in the ship to operate on any wave length between 30 and 900 meters. Weight 16 lbs. 6 ozs. Price $1,000 f.o.b., New York.



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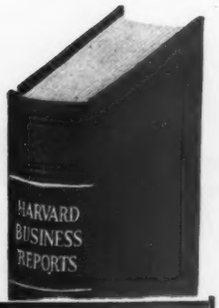

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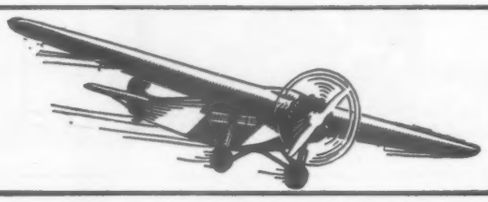

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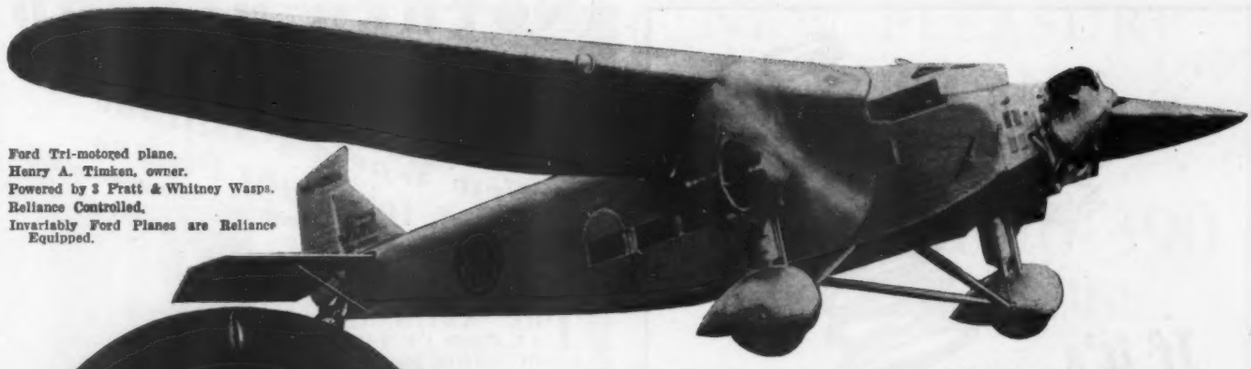

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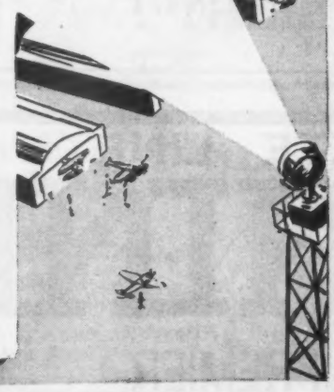

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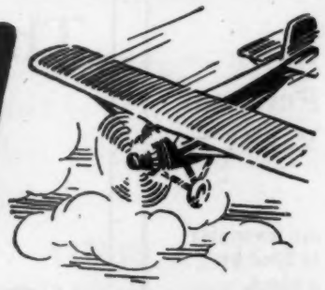

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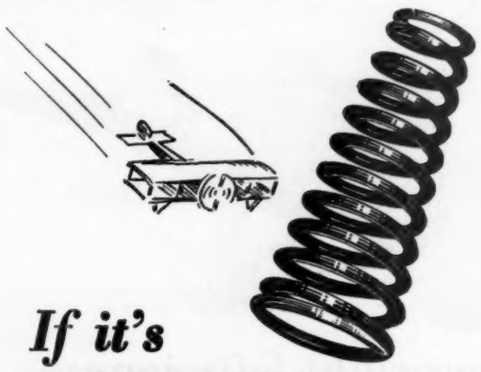

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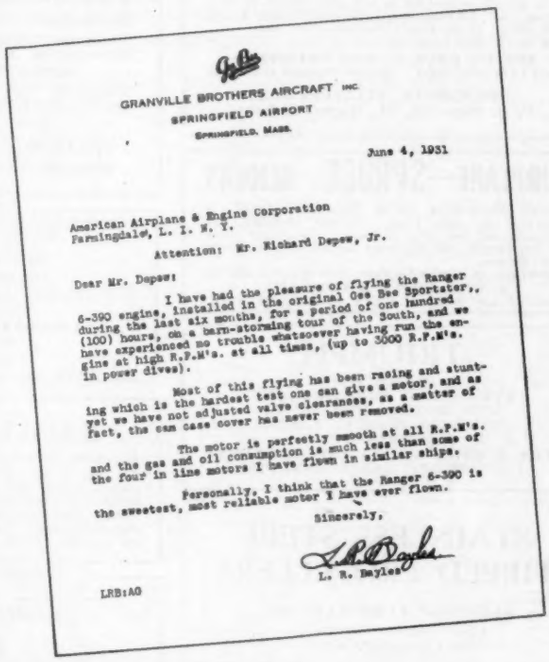

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June 4, 1931

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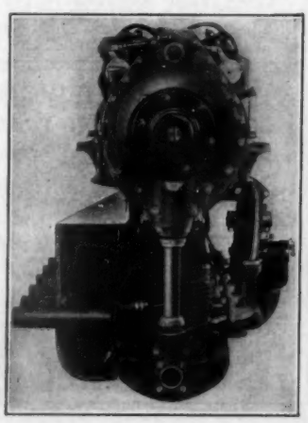

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AMERICAN Eagle Wright Hisso E powered biplane. Motor just rebuilt, N. C. license. Price $1,000 cash. New Edo pontoons for same, $500. J. C. Rinehart, 601 Morgan Bldg., Portland, Oregon.

COMPLETELY equipped flying office. Travelair, six-place with complete office equipment, including desk, files, Ediphone, typewriter, etc. Finest equipped plane of its kind and in good condition. Sacrifice price. For further particulars, write FS-123, Aviation, 520 No. Michigan Ave., Chicago, Ill.

CURTISS Seagull flying boat, four-place, licensed, excellent condition; price $2,200. Two J-5 five-place Ireland Amphibions, prices $3,000 and $3,500 each. Also five-place Wasp powered cabin Ireland Amphibion, like new throughout, 120 hours on motor, price $7,500. Curtiss Air Station, Atlantic City, N. J.

FOR SALE: J-5 Travelair, just relicensed. Cheap for quick sale. FS-102, Aviation, 520 No. Michigan Ave., Chicago, Ill.

FOR SALE: Aeromarine-Klemm monoplane, with Le Blond 60 hp. motor. Good performance. Located at Red Bank airport, Red Bank, New Jersey. Will gladly demonstrate. Price $750. Laurence Raynolds, Allenhurst, New Jersey.

FOR SALE: Six- (6) passenger Stinson Detroiter monoplane. "N C" licensed. Extreme sacrifice. Wings, fuselage and motor in perfect condition. Wire or write R. J. Wall, 221 Ontario St., Toledo, Ohio. Phone Main 1234.

FOR SALE: One Travelair biplane, Wright J-5, total time 240 hours. Just overhauled and re-covered. Motor in excellent condition. Steel propeller, Townend ring, heaters in cockpits. Fuselage painted Berrylold cessna red. Wings and tail surfaces Sun Glow. Wonderful buy at $2,750. Signed Stewart, Care of Curtiss-Wright Flying Service, Memphis, Tennesse.

FOR SALE: Waco 10, licensed, $985, licensed fuselage $125, tail $40, gear $35, motor cowling $20, N struts, pair $12, Hisso propeller $10, OX-5 $90. Other bargains. Ellsworth Airways, Ellsworth, Wis.

FOR SALE: Cleone, good condition, 25 horsepower, best bid over $50. OX-5, turning 1,450 in air, good condition, as is best over $75. Pietenpol camper, mostly complete $200. Workmanship first-class. Ford A motor, 6,000 miles, $85. Fred Wharton, Jacksonville, Ill.

FOR SALE or trade: One four-place cabin ship, 300 hp. Hisso motor. $2,500 cash or will trade for tract of Colorado or Ozark land in Missouri or Arkansas. Write me what you have. Dr. C. E. Richter, 934 N. Lawrence Ave., Apt. 5, Wichita, Kansas.

FOR SALE: One cracked up American Eagle biplane, with OX-5 motor. I would like to sell or trade. FS-117, Aviation, 520 No. Michigan Ave., Chicago, Ill.

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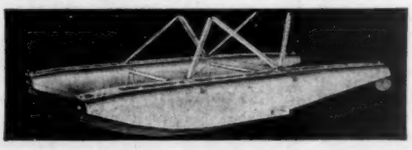

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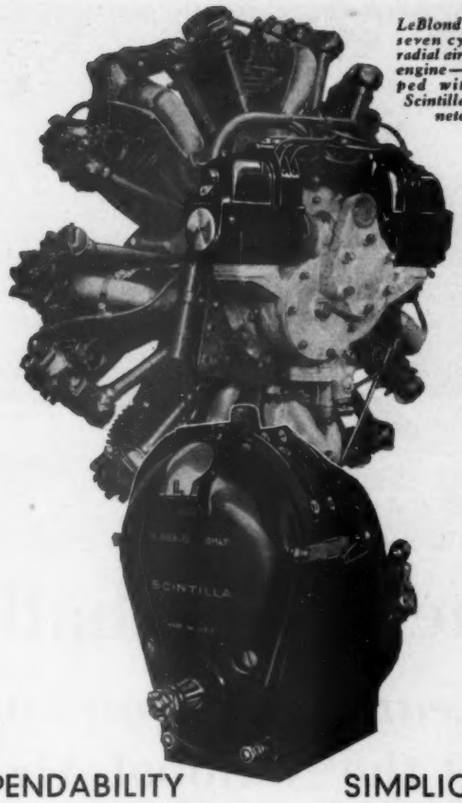

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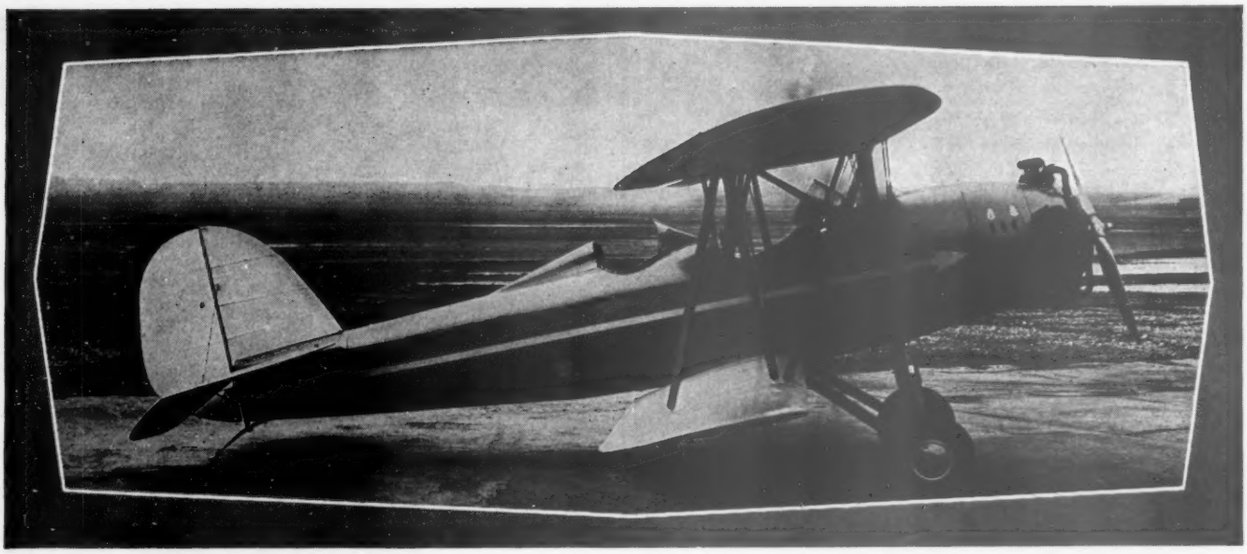

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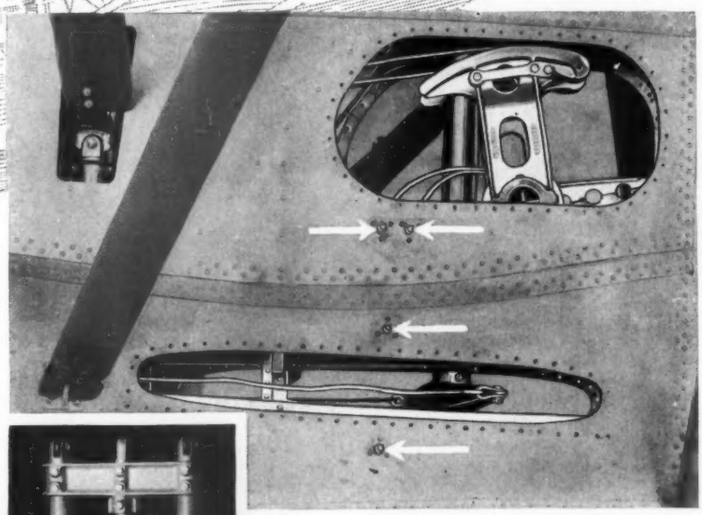
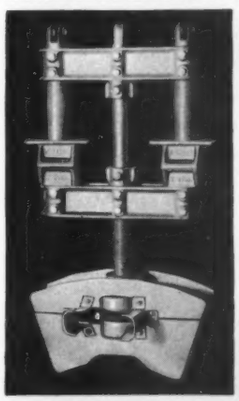
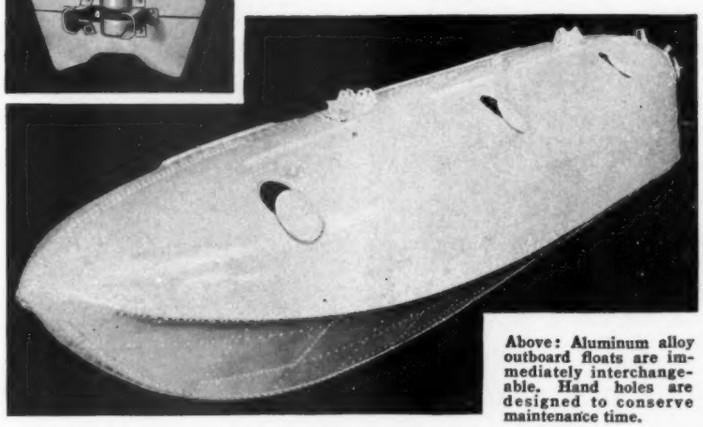


Above: Lubrication of all moving parts in the tail group is quickly accomplished through outside Zerk fittings, some ofwhich are indicated by the arrows above. Plates over these moving parts need be removed only for periodic inspection.



Left: The famous Martin stabilizer adjusting gear—so designed that it functions perfectly without the slightest attention. Another example of Martin's sturdy construction.



Above: Aluminum alloy outboard floats are immediately interchangeable. Hand holes are designed to conserve maintenance time.

INSPECTION doors and fixed windows afford quick access to important parts. Fixed length struts eliminate rigging troubles. Pressure grease fittings simplify lubrication. The positive stabilizer adjusting gear needs no attention. The same is true of the grease packed, ball-bearing type pulleys. Even on large Martin Patrol Bombers, removing four bolts detaches an engine mount . . . or a fuel tank . . . or an outboard float.

These simplified maintenance features are typical of every detail of Martin construction. Equally important, replacement parts are quickly obtainable when needed—and always fit perfectly. Martin parts are made with such precision that they are immediately interchangeable from one plane to another of the same type.

Nowhere else in the industry will you find so much equipment for the exact duplication of aircraft parts as in the Martin plant. Nowhere else in the industry can aircraft of equal quality be produced in quantity at lower cost.

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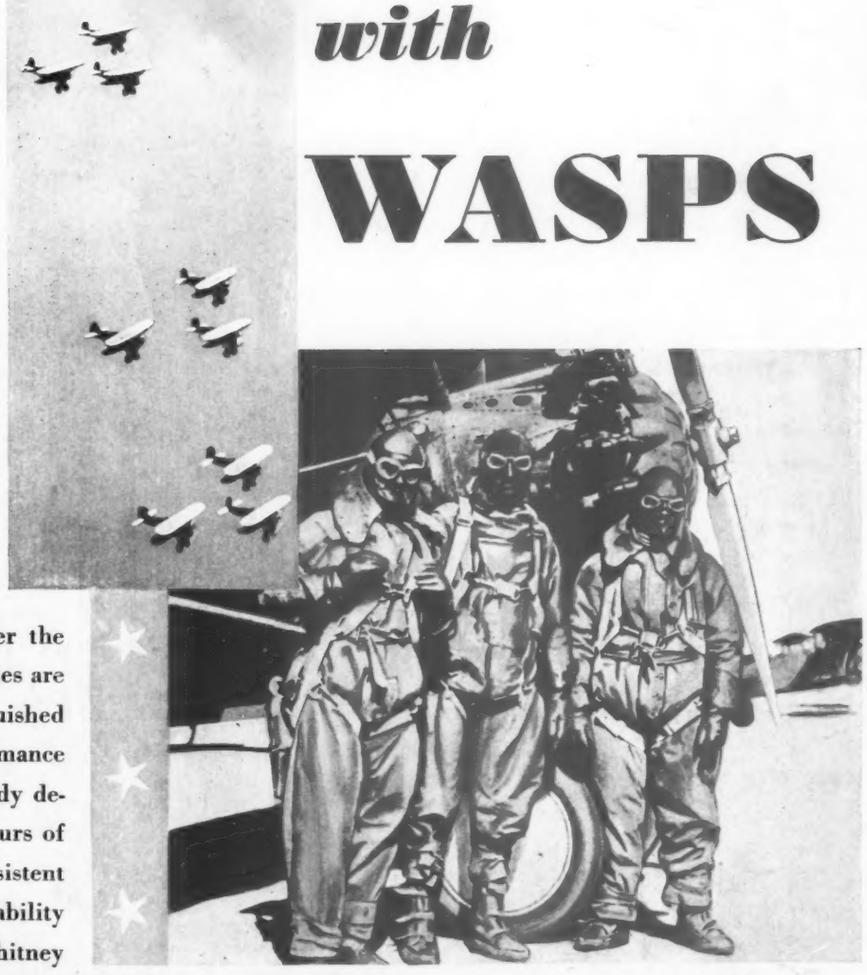
Flying 6 miles high with WASPS

Formation flying at over 30,000 feet! That's a regular maneuver of one of the Army's crack pursuit squadrons—the 95th—stationed at Rockwell Field, California. At an altitude of six miles above the earth the squadron's pilots have developed a technique of formation flying unique in aviation annals. Such performance provides an exacting test of personnel, planes, *and power.*

The Wasp engines which power the 95th's efficient Boeing pursuit planes are worthy members of this distinguished combination. Their brilliant performance at high altitudes—like their steady delivery of power through long hours of routine flying—is marked by consistent dependability. That same dependability accounts for the use of Pratt & Whitney engines in every type of flying where power reliability cannot be left open to question.



Pictured in the narrow panel above are some of the 95th Pursuit Squadron's Wasp-powered Boeing planes, flying at 18,000 feet. The lower illustration shows a group of pilots of this famous organization dressed for an altitude flight over Rockwell Field.

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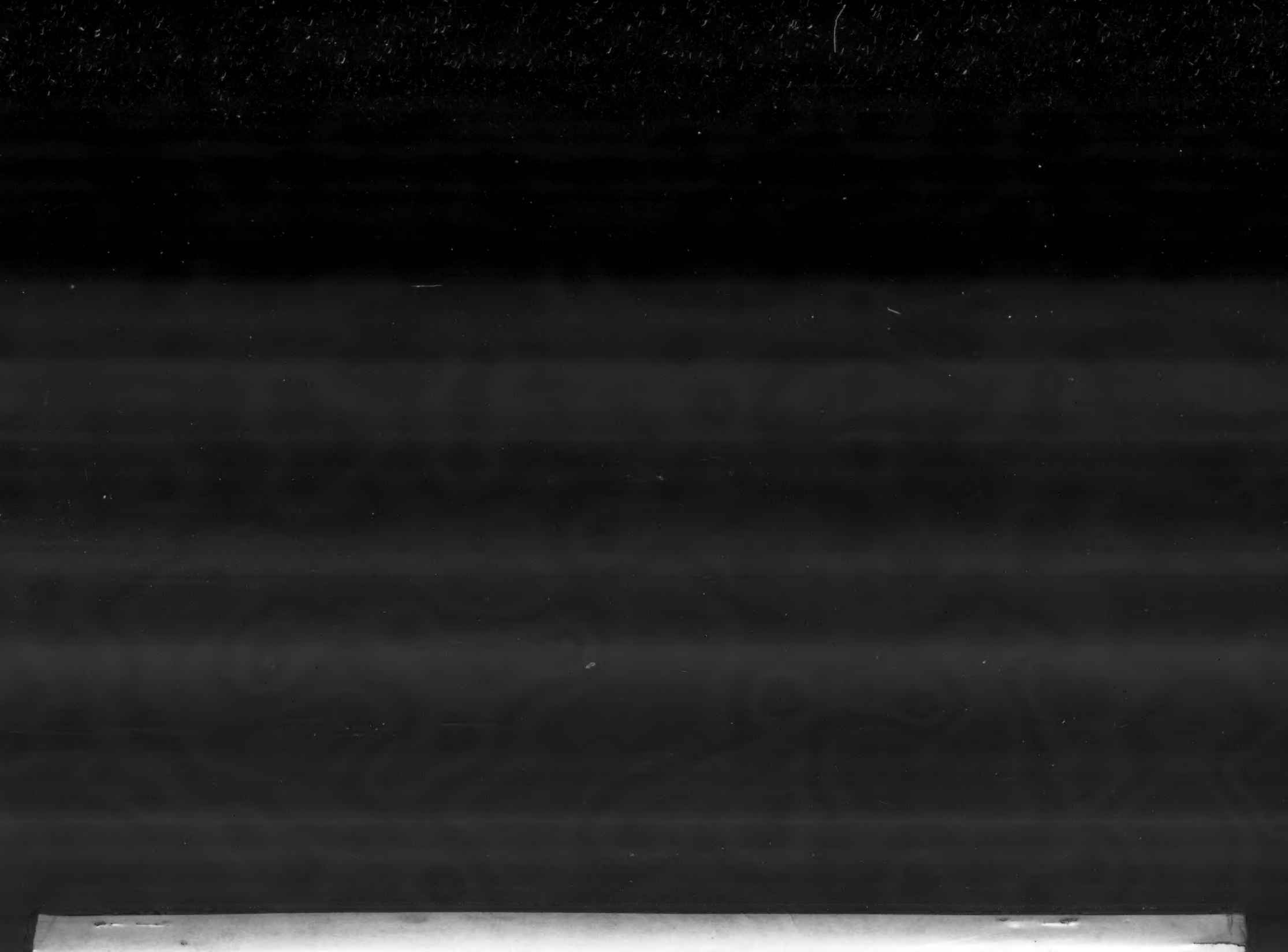
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